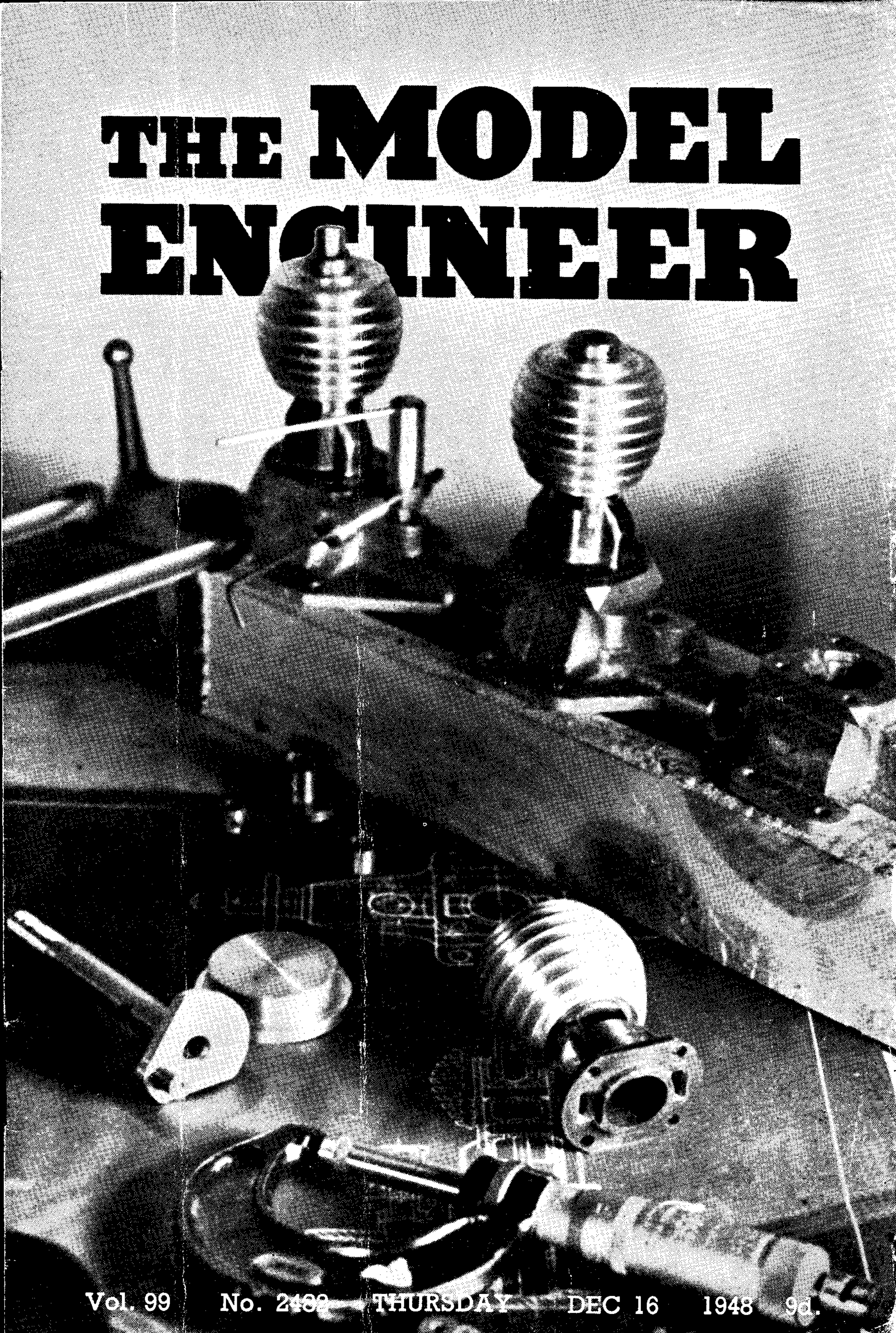
THE MODEL ENGINEER



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The MODEL ENGINEER

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SMOKE RINGS

Our Cover Picture

● THIS PHOTOGRAPH, submitted to us by Mr. W. C. Cox, of Carshalton, may aptly be titled "The Birth of a Model." It depicts the evolution of a small compression-ignition engine from the drawing board stage onwards, showing the various components in progressive stages of machining and assembling. A further point of interest in the photograph is that the draughting machine used for making the drawings, part of which is visible, was constructed from the design by Mr. Ian Bradley which appeared in THE MODEL ENGINEER some years ago.—E.T.W.

Corrigendum

● IN MY note about saddle-tank locomotives, which was published in the November 11th issue, I made a mistake in stating that the Ministry of Supply chose one of Hudswell, Clarke's proprietory designs for war-time use. The chosen design was one of the Hunslet Engine Company's, and was slightly modified to meet the requirements of the Ministry. I apologise to both the firms mentioned.—J.N.M.

A Saddle-tank "Pet"

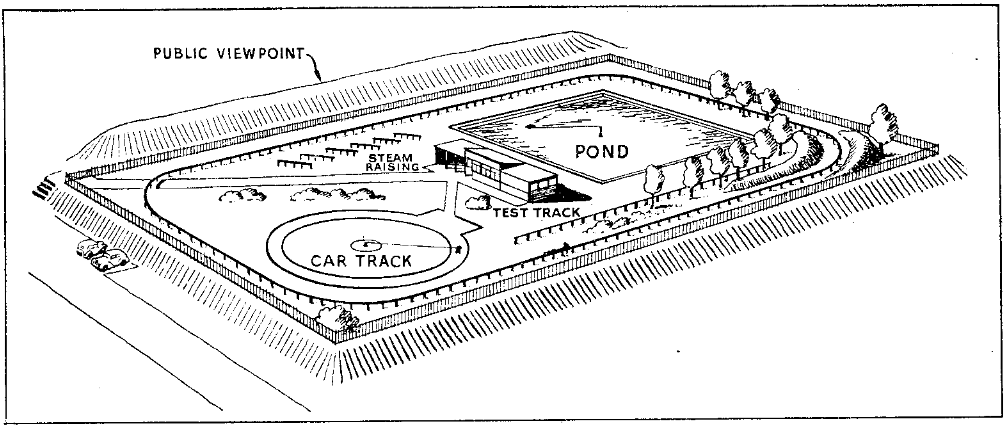
● WRITING ABOUT saddle-tank locomotives reminds me that, up to now, I have not mentioned a particular pet of mine. This is G.W.R. saddle-tank engine 0-6-0 No. 1925 which, since the end of 1942, has been stationed at Southall. Except for two breaks, of about eight weeks each, I have seen this engine at least once every day. At first, she was employed in shunting duties at West Ealing every morning; but a rather interesting point to notice was that, invariably, she was one way round one day and the opposite way about the next, suggesting that the complete turn of daily duty took her round some triangular route.

During the past twelve months, however, the engine has worked down from Southall to West Drayton, each day, for shunting duties. I still see her every morning, on my way up from Maidenhead to London, as she is usually standing in the sidings at Hayes, waiting "for the road" to enable her to proceed to West Drayton. Her train frequently consists of no more than one truck and a brake-van, though sometimes it is no more than the brake-van!

No. 1925 is quite a veteran; she was built at Swindon in 1884. She carries her years very well and seems to be in very good fettle. But those responsible for her care at Southall do not seem to think she is worth cleaning; I do not believe they have ever done so much as rub her down since she has been there. For some reason, she is one of the three which have never been altered to pannier-tanks.—J.N.M.

Club Patrons

● MOST OF the model engineering clubs are entirely dependent upon the efforts and enthusiasm of their own small band of members, and often struggle under severe financial handicaps, especially in their early days.



Such difficulties, however, can often be overcome by making the right contacts, especially now that the general public are becoming more model-minded with every week that passes.

Often financial and practical help can be obtained by pointing out the mutual advantage to public and commercial bodies that can accrue as the result of co-operation between such bodies and the local society. As an example of a club fortunate in having the patronage and practical support of a large commercial undertaking, we have recently heard from the Stanton Society of Experimental Engineers and Craftsmen. This society, formed only ten months ago, has had placed at its disposal by the company's directors the entire facilities of the apprentices' training school of The Stanton Iron Works Co. Ltd.

The school is a splendid modern building, comprising fully-equipped pattern shop, foundry, machine and fitting shops, classrooms, lecture room, offices and all the other amenities usual in a well-planned building of this type. This splendid gesture by its directors will, we feel sure, go far to enhance the reputation of The Stanton Iron Works and provide a fine foundation upon which the society may build its membership.—P.D.

Bolton, Too

● ANOTHER SOCIETY fortunate in having the patronage of a powerful body, is the Bolton and District Society of Model Engineers, which recently opened its new sports arena, comprising a model racing car track, boating pond, and 800 ft. of continuous multi-gauge model rail track. The site for this arena, shown in our illustration, was given to the society by the Bolton Corporation, who we learn have given whole-hearted co-operation, not only in the matter of the arena, but also in providing facilities for the society's annual exhibition.

We feel sure that the number of people drawn to the park as the result of the Corporation's generosity, will fully justify its enterprising and far-sighted policy. We believe, too, that the fortune that has come to the Bolton and Stanton societies, given the right approach, may also be forthcoming for other societies throughout the country.—P.D.

A Barimar Repair

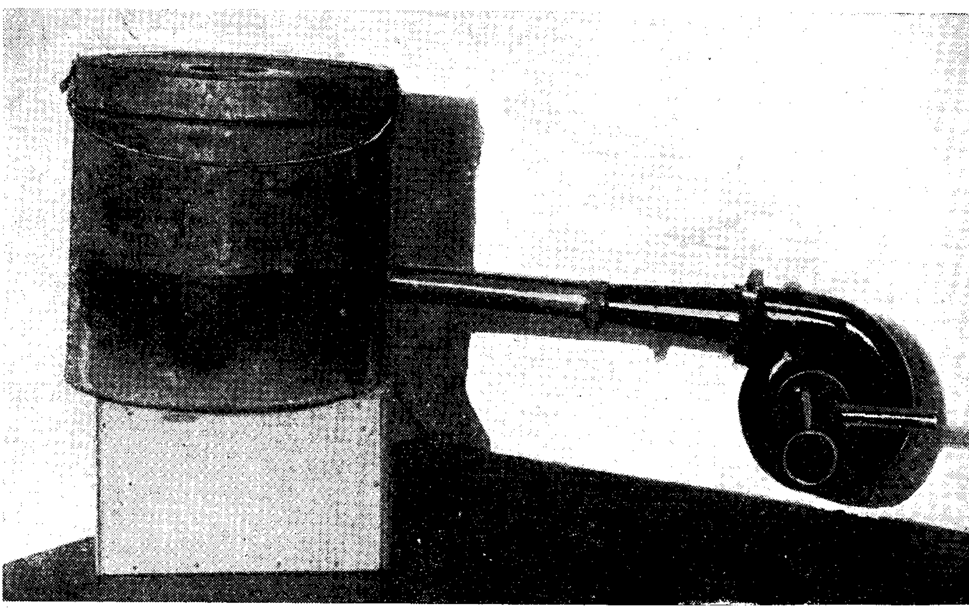
● EVERYONE CONNECTED with engineering is familiar with the name of Messrs. Barimar Ltd., whose achievements in the repair of all kinds of machinery, over the course of many years, have built up a unique reputation in this class of work. In the realm of full-sized engineering, they have given a new lease of life to innumerable machines which would otherwise have been completely scrapped; but it is, perhaps, less widely known that they can cope equally well with very small and intricate repairs.

Some years ago, I was invited by Messrs. Barimar to submit to them any model in need of repair, but at the time I was unable to avail myself of the opportunity to prove their qualifications in this respect. My own engines—whether due to good design or good luck—have rarely suffered from any major breakdowns, although subjected to gruelling tests to find their weak points. But recently, when running a 5-c.c. engine with a metal airscrew which had not been properly balanced, very severe vibration was set up, the ultimate result of which was to start cracks in both the engine bearers at their junction with the crankcase, and one of them became completely broken away before the exact cause of trouble had been located. The only alternative to renewing the entire crankcase was to get the bearers welded, but the operation was an extremely delicate one, as the crankcase wall was only $\frac{1}{16}$ in. thick and the upper part had an inserted iron liner, the removal of which it was not deemed desirable to attempt. It was decided to submit the problem to Messrs. Barimar, who undertook the repair without hesitation and promptly carried it out. The engine is now again in service, and as good as ever—in fact, it is no exaggeration to say better than ever, as the fillet at the junction of the bearers with the crankcase has been increased in radius at my suggestion, thereby reinforcing the strength at this critical point.—E.T.W.

Constructing a Crucible Furnace

by A. R. Turpin

I SUPPOSE most readers at sometime or other have had the annoying experience of waiting weeks for a casting, only to find, when they started to machine it, a nasty blow-hole where it really mattered ; even the best foundries have had this happen ; or perhaps (though never let it be said), drilled a hole where " Curly " never told them to drill it.



The crucible furnace with burner attached

It was after such an experience as this—though I won't say which, when the air of the workshop was so blue that even the carbide-tipped tools appeared to wilt, that I decided to start my own foundry.

The first thing to consider was the furnace, and I decided that my gas torch described in THE MODEL ENGINEER, October 14th, 1948, would be able to supply the heat, as 2 lb. of bronze would be about the maximum size of casting I should require. The furnace would have to be small because my workshop is as crowded as most, and as it would only be used occasionally, it was not worth a large expenditure. Now my gas torch burns 20 cu. ft. of gas per hour as measured on the " third of a cubic foot " dial on the gas meter, or something over 10,000 B.Th.U., and a No. 1a plumbago crucible would just about hold 2 lb. of bronze, so I now had something on which to base a design. At a rough guess, I decided that it would take not more than 500 B.Th.U. to melt 2 lb. of bronze, but it would take quite a lot of heat starting from cold, as I should normally have to, as my demands would usually be for single castings only. So I decided to make the walls of the furnace comparatively thin and not bother too much about heat insulation, eventually considering their thickness from a structural strength point of view only. The final design was that shown in Fig. 1.

At first I tried to obtain a cylinder of refractory material " already cast " in the size I wanted, but this was unobtainable ; so I decided that I would use a plastic fireclay. My final choice was to use " Triangle " (fireclay) Ramming Material No. 7, obtainable from Messrs. Coupe & Tidman Ltd, Treforest Trading Estate, Pontypridd, Glam. This costs 10s. for 28 lb., or 24s. for 1 cwt., carriage paid. The material is very heavy and a 28 lb. keg was only just sufficient for the job. It is a very stiff clay with a pronounced granular texture, and I found the best way to use it was to cut out a chunk from the keg with a trowel, chop it up into quite small pieces and then ram it into the mould in layers with a length of $1\frac{1}{4}$-in. iron bar.

The fireclay having arrived, I scrounged a large paint drum measuring 8 in. in diameter and 12 in.

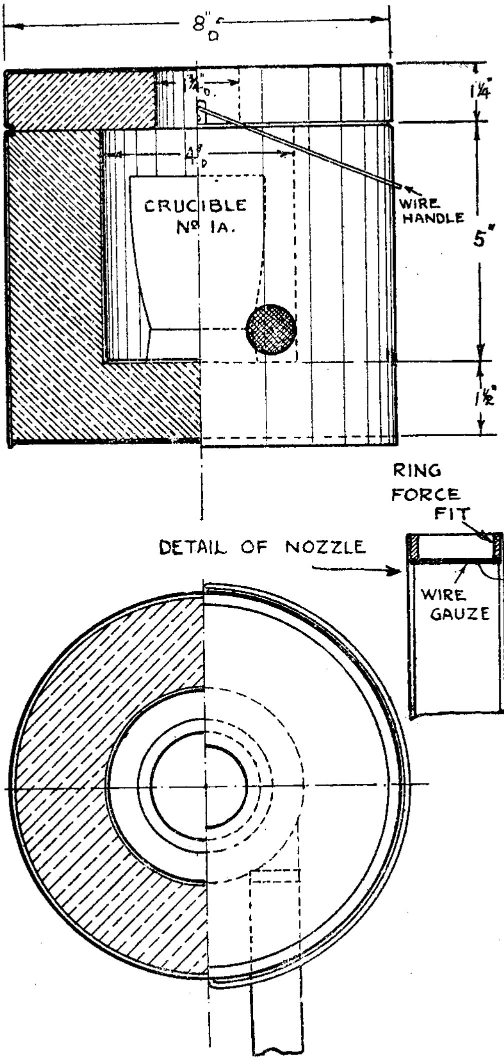


Fig. 1. *The prototype furnace*

high. This was cut down to 6¾ in. high and a 1-in. diameter hole cut slightly elliptical in the side of it with the centre 2½ in. from the bottom. A smaller but stout drum 4 in. diameter was also found and cut down to 5 in. high, with a 1-in. diameter hole cut elliptically in the side but touching the bottom of the drum. A second hole 2 in. diameter was cut in the centre of the bottom.

The fireclay was then chopped up and rammed in a layer 1½ in. deep at the bottom of the large drum and made perfectly flat and smooth ; I did this by giving it a further ramming with (horror of horrors !) my lathe faceplate. Next, the small drum was placed in the centre of the larger, and a piece of 1-in. diameter broomstick threaded through the holes in the side of the two drums, and the inner one twisted so that the stick entered it tangentially, hence the elliptical holes. This piece of broomstick was eventually replaced by the burner, and as the flame will also enter the bore tangentially, it will swirl round the crucible, heating it more or less evenly. I continued ramming in the fireclay in the space between the two drums, taking special care to consolidate it well round the broomstick, until it reached the top of the inner drum, then finished it off smooth with the faceplate.

Next, I cut a strip of sheet metal of a convenient gauge and bent it round into a 2-in. circle. This was pushed into the hole in the bottom of the inner drum and rammed full of clay, this making the stand for the crucible. The broomstick was carefully pulled out with screwing motion and the job put aside to dry for 24 hours.

The top piece of the drum which was cut off and which luckily had a wire handle attached to it was cut down to 1¾ in. deep, and rammed to a depth of 1½ in. This done, I found a piece of 1½-in. diameter tube and with it cut a hole for a vent in the centre of this slab which was to be the lid, and placed this aside to dry.

There was then ¼ in. of metal standing proud on both the body and the lid of the furnace, so next day when the clay has hardened up a bit, I tapped this gently down all round to make a neat finish to the job.

By the way, the lid portion not only had a wire handle attached, but also had a turned-in rim which would hold the slab of fireclay in place when dry and some shrinkage had taken place ; if your drum has neither, leave extra metal which should be hammered over to form an internal lip before ramming, and drill ⅛-in. diameter holes on opposite sides and push the drill well through these holes and into the clay after ramming, so that when baked these holes can be used to insert the end of a piano-wire handle ; but this should not be done until after it has had its first firing.

The burner was next taken in hand, and as there was likely to be some back pressure, a flame trap was deemed necessary, so this was incorporated in the set-up. A 12-in. length of 16-s.w.g. steel tube was obtained and the inside of one end turned to a diameter of $\frac{15}{16}$ in. The coffee-strainer was next surreptitiously snaffled from the kitchen and a $\frac{15}{16}$-in. disc cut out of the wire gauze ; if you haven't got a coffee-strainer, ordinary *steel* wire about 30-mesh gauze will do. Next I turned up a ring of mild-steel ¼ in. wide with an inside diameter of ¾ in. and a drive fit in the end of the tube. The disc of gauze was placed squarely in the end of the tube and the ring driven in so that it held it firmly in place, (see large detail, Fig. 1). The other end of the tube had four saw-cuts made down it for ¾ in., and the whole was clamped to the end of the torch by means of a 1-in. jubilee clip. If you wanted to make the job permanent, make a new flange to fit the blower and braze this on to the end of the pipe.

When everything had been completed, the steel tube was pushed in to take the place of the piece of broomstick, which had previously been withdrawn, so that the nozzle end was just level

with the inside of the cylinder, as shown in the drawing. The torch was then lit and the air and gas turned down to the smallest possible flame and the whole thing allowed to warm up slowly for about two hours ; then the heat was gradually increased until I had it going full blast at the end of four hours. I then allowed it to stand until next day, when I decided it would be ready for use.

As a test, I placed a short length of copper bar in a crucible, lit the torch and started to time things. In a few minutes the crucible and contents were a good cherry-red and, I expected the copper to become molten at any moment after that, but after half an hour it was still in bar form and only perceptibly brighter. I also noticed that there was a considerable amount of flame coming out of the vent which I knew to be waste heat, but as I had the air vent fully open I could not do much except turn down the gas which didn't seem to me a good way to increase the heat, and it wasn't. After 45 minutes the bar subsided in a molten mass at the bottom of the crucible. This did not seem good enough, so I decided to try to increase the air pressure by rewinding my transformer to give me a choice of 12, 14 and 16 volts, the output at the first trial being barely 11 volts, owing to a voltage drop in the long leads to the blower.

When the change had been completed I connected up to the 14 volts and immediately got some real life in the blower and, turning the gas full on, got an entirely different flame, a flame that was practically invisible except close to the nozzle, and when the lid was replaced just a trace of flame showed through the vent. This time the copper was molten 17 minutes after lighting up from cold, and as most of the heat had obviously been absorbed in heating up the furnace, this seemed good enough for me ; but to make sure, a new crucible was placed in the hot furnace and timed again, and this showed a big improvement, as the copper bar had melted in just over six minutes.

Now I do not think that there is such a great heat loss as I expected because, although the metal of the inside drum was burnt almost completely away after three firings, as can be seen from the photograph which was taken after ten firings, the label on the outside is only slightly scorched. For myself, as I am only likely to want to use this furnace occasionally, this rough arrangement is good enough, but for anyone who may require to use it more often, such as a club, then something more efficient as far as fuel consumption is concerned, and more substantial in construction, may be desired ; and so I have shown in Fig. 2 my design for such a furnace. The main difference is the thickness of the walls which have been increased to 3 in. and the lid and bottom thickness have also been increased. The wire gauze flame-trap has been replaced by a fishtail nozzle fitted with thin strips of, preferably, stainless steel which are force fits into $\frac{3}{8}$ in. deep saw-cuts, see enlarged detail. In order to get the nozzle on, it is pushed on from the inside of the furnace after the steel pipe has been bolted in place by means of a flange that has been previously welded or brazed to it, and shaped to fit the periphery of the cylinder. It is also advisable to braze or weld the holding-bolts to the casting so that they do not turn.

The lid is swivelled on a pin hinge, and some clearance should be allowed between the lid and the top, the brackets being riveted to the casing as shown. The casing itself can be fabricated from 18 or 20 s.w.g. mild-steel sheet, with the seam butt-welded or lapped and riveted, and because of the thickness of the metal used, it would be as well to beat over the edges of the lid and top of the cylinder before filling with fire-clay. The rest of the design is self-explanatory.

Many may find that a crucible holding only

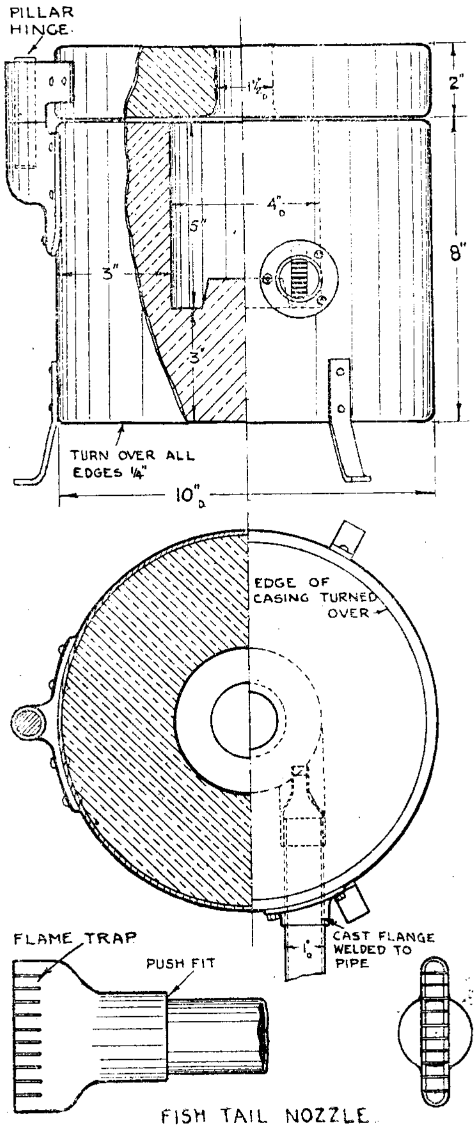


Fig. 2. A more elaborate furnace

2 lb. of bronze insufficient, but I see no reason why a No. 2a size, which will hold twice this amount, should not be used; the size overall of this crucible is 4 in. high × $3\frac{1}{8}$ in. diameter, against $3\frac{1}{8}$ in. × $2\frac{3}{4}$ in. for the No. 1a size, and therefore the diameter of the cylinder bore will have only to be increased a $\frac{1}{4}$ in. and the inside

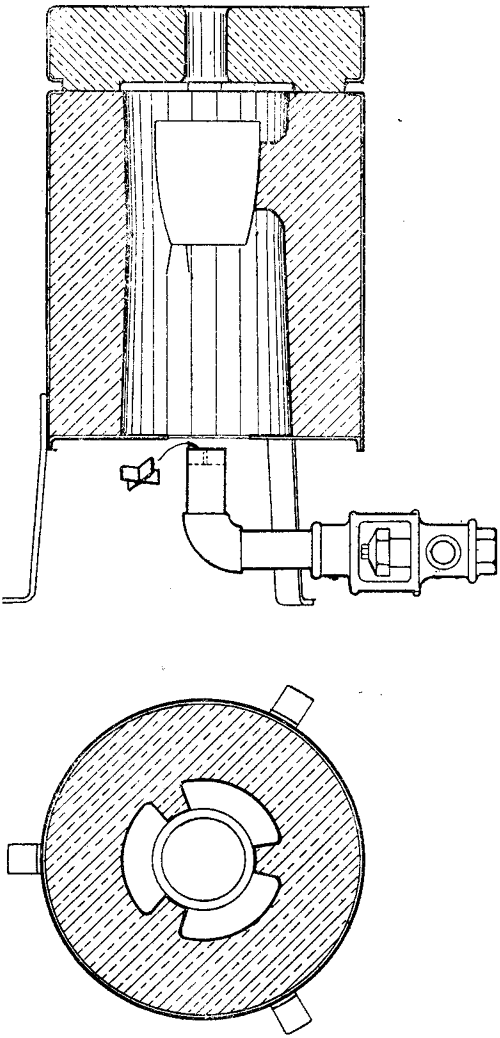


Fig. 3. A suggested furnace for a low-pressure burner

height by about $\frac{7}{8}$ in. Now if the walls are kept the same thickness, this will mean an increase of surface area of less than one fifth, and as most of the heat goes in heating up the furnace and making up the loss through the walls, and as I have found that it is still possible to make a melt with the gas turned down 50 per cent., the suggestion would appear to be quite feasible; the melting time would, of course, be increased somewhat. I would mention here that the occasion of my test at a lower consumption was an enforced one. I happened to be making a melt on the first really cold night this winter and, as I noticed the furnace seemed to be taking a very long time to heat up, I checked the gas consumption on the meter and found it was only using 12 ft. per hour against the usual 20, owing to a low pressure. As a result, not only was too much air being used, but because of this, the flame was burning right up against the wire gauze of the flame trap, and had burned it through at just about the time I noticed it. However, a new gauze was soon fitted and I then found that the air supply had to be almost completely closed to give an efficient flame, and under these conditions the melt of copper took over one hour.

One advantage of the swivel lid is that it may be used as a table for heating a mould. The mould may be supported clear of the vent and covered with a biscuit-tin which has a second vent in the top. The mould may be heated up whilst the melt is proceeding, and when the tin is removed, and the lid swivelled to one side with the mould still on it, the metal can be poured straight away.

Some readers may not have a blower available and wonder if it would be possible to use an ordinary gas injector. Well, I have tried this out using a $\frac{1}{2}$-in. injector but with little success, mainly on account of the lack of draught, and on consulting the local gasworks research department, was informed that a better arrangement under these circumstances would be that shown in Fig. 3. In this case, the burner is directly below the crucible and a better natural draught is formed. The best position of the burner would have to be found by trial, and I would suggest either a 1-in. or $\frac{3}{4}$-in. Keith-Blackman injector be tried. The correct size of gas barrel should be screwed into the injector (the length including the bend is not important provided it is over about 4 in. long). The outlet end should have a thin metal cross let into it to act as a flame-trap. The vent is made smaller and most of the gases allowed to escape by raising the lid about $\frac{3}{8}$ in. by means of lugs cast in the fireclay formation.

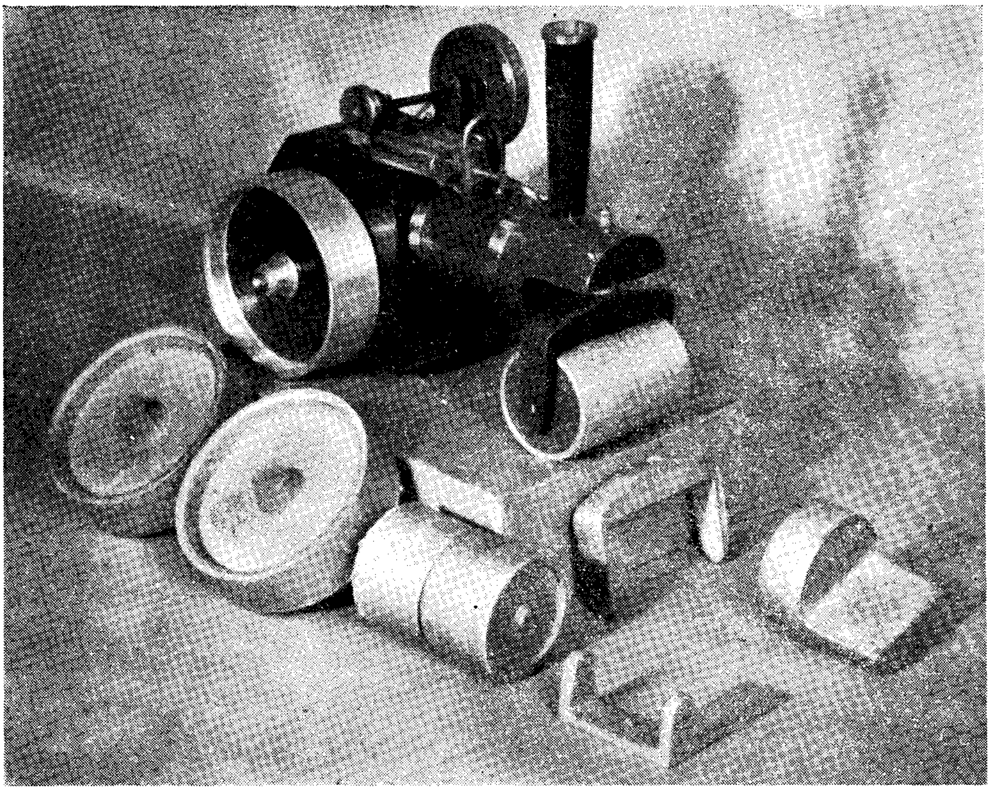
In order to form the supports for the crucible, which are part and parcel of the fireclay cylinder, a special wooden core should be made in two parts, and the shape of the support lugs carved out of them. As the bottom half of the core will have to be withdrawn downward, a temporary false bottom must be used and the permanent one fixed afterwards. The fireclay must be rammed well into the recesses forming the supports and it might be as well to do this before the top half of the core is inserted.

Now these furnaces have other uses than melting metal for castings. They can be used for annealing and normalising, forging and carburising; and, if the article is enclosed in a crucible with a cover, sintering or enamelling.

When using this furnace, there are a number of precautions that should be taken. When you drop a red-hot iron bar you can either quickly

(*Continued on next page*)

A TOY STEAM-ROLLER



OUR illustration shows a set of castings in aluminium-alloy, which require only very simple machining to make up into a toy steam-roller suitable for a youngster. A completed roller is included in the illustration.

We commend these castings to the attention of any reader who may care to make an entertaining present for a small boy, easily and cheaply. They have been placed on the market by Lamedos Industries Ltd., Lamedos Works, 92a High Street, Eton, Bucks, and are available from Gamages, Hamleys and other toyshops, from whom, also, the complete roller can be obtained.

The roller is a spirit-fired, steam-driven toy of the simplest possible type ; it has an oscillating cylinder driving a circular crank on one end of the crankshaft, at the other end of which a flywheel is fitted. The model is steered by the roller which can be set so that either a straight or a curved course will be traversed. The spirit-lamp fits into a recessed firebox at the rear end of the boiler. A long, endless spring "belt" transmits the drive from the crankshaft to one of the rear wheels.

Constructing a Crucible Furnace

(*Continued from previous page*)

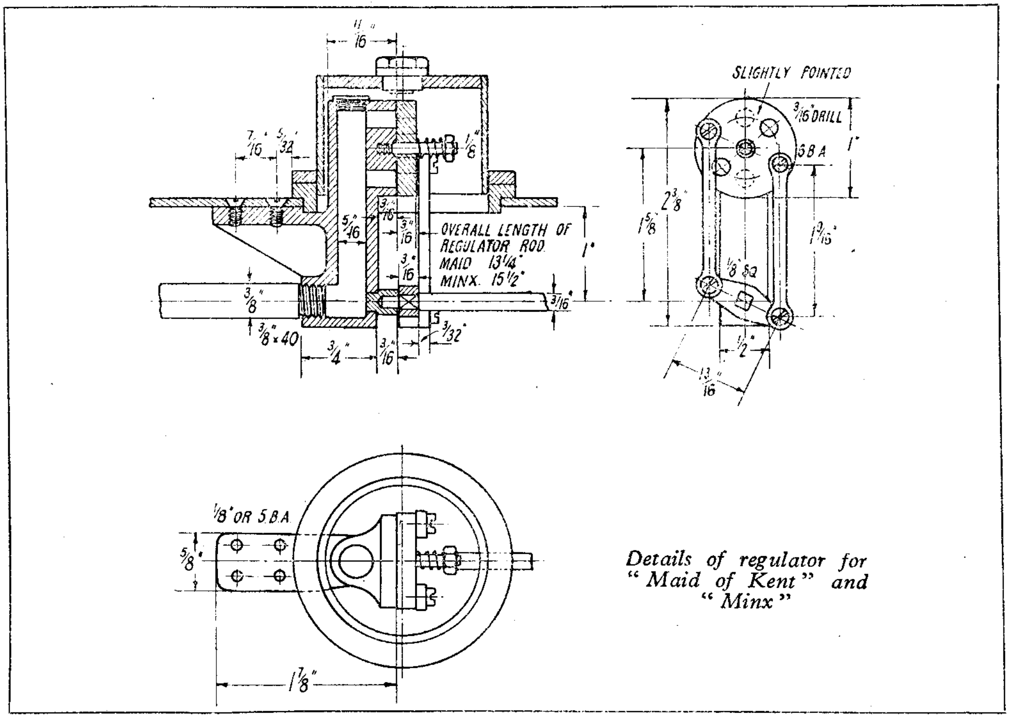
pick it up in a pair of tongs or kick it around until it is cool, but you can't do either of these things with molten metal.

The safest plan is to mount a large drip-tray on bricks, without raising it too high, and after covering it ½ in. deep with sand, place the furnace and any moulding flasks on this. Always wear goggles or glasses, and protect the hands with gloves. Lift the crucible out with long-handled tongs, and don't use the crucible too many times ; they are cheap and should be discarded at the first sign of wear. Have an old bucket with a brick in it to tap off the red-hot dross and slag from your skimming iron, as lumps of this are apt to fly in all directions ; and have a bucket of water handy. The law requires a back-pressure valve to be fitted between any pressure-operated gas appliance and the mains.

Regulator for "Maid" and "Minx"

by "L.B.S.C."

IT was, in a manner of speaking, a toss-up as to which type of regulator I should describe for the two 5-in. gauge locomotives. The full-sized Southern "L1" class have slide-valve regulators, and the original "Minxes" had the rotating disc pattern; I don't know what type the Marsh rebuilds had, as I never saw one out. However, of the two I prefer the disc. The flat slide must needs have two flat springs, necessitating four spring pillars; and unless you set its head on cock-eyed, it has to be opened and closed by a connecting-rod operating at a permanent angle. The disc only needs one spring pillar, and can be operated by twin connecting-links; also, by using two ports, all chances of restricting the steam flow on "all-out" working is avoided. Once the valve is tight, which is simply a matter of careful workmanship, it remains tight, as it can be lubricated any time, merely by unscrewing the plug on the dome, and giving it a spot of oil. A properly-lubricated valve will not score, and start leaking. During the last quarter-century, I have made scores of regulator-valves; and the type specified here has given perfect trouble-free service every time. I always use it wherever the size of the dome permits. Both "Jeanie Deans" and "Grosvenor" have this type of regulator, and I shall fit a similar one to "Bantam Cock."



Details of regulator for "Maid of Kent" and "Minx"

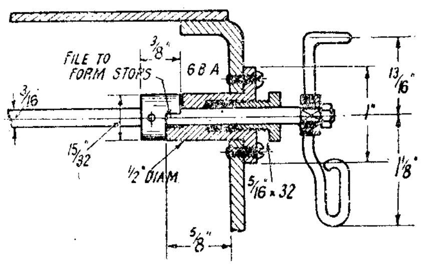
Stand and Valve

Castings will be provided for the stand, which will save time and trouble. The stand consists of a column or pillar, with a circular boss at the top, to form the working face over which the valve operates. At the bottom is a large boss for the steam pipe, and a small one for the spigot on the end of the regulator rod. On the opposite side to the valve boss, is a bracket with a rib underneath, for extra strength, the bracket forming the attachment to the boiler shell. As the length from the end of the bracket to the back of the column below the valve boss, is $\frac{1}{16}$ in. less than the diameter of the hole in the dome bush, there will be no trouble in inserting the regulator and manoeuvring it into position when erecting.

The casting needs but little attention. Smooth off the top of the bracket with a file, to approximately the same radius as the inside of the boiler shell; a weeny bit flatter, if anything, so that both outer edges touch the shell when the screws are tightened, and there is no rocking. File a little notch close to the pillar, to clear the little bit of dome bush that projects inside the boiler,

Note, the column should miss the hole in the bush by $\frac{1}{8}$ in., to allow plenty of room to put the cover on; see section. Might as well fit the screws as well, whilst you are about it; so drill four No. 30 holes just ahead of the dome bush, at the position shown in the plan, and countersink them. Hold the casting in position, with the bracket inside the boiler under the holes; mark the position of one with a scriber. Remove, drill the marked spot No. 40, tap $\frac{1}{8}$ in. or 5 B.A., replace and put a screw in. See that the column is in its right position in the dome bush; then run the 30 drill through the other three holes, making countersinks on the bracket; follow with No. 40, and tap $\frac{1}{8}$ in. or 5 B.A.

Chuck the casting in the four-jaw with the valve boss running truly. Face it off, centre, drill No. 40 for $\frac{3}{16}$ in. depth, countersink the hole a little, and tap $\frac{1}{8}$ in. or 5 B.A. Centre-pop the boss at the bottom, and drill it 11/32 in., for about $\frac{1}{2}$ in. depth; tap $\frac{3}{8}$ in. by 40 for the steam pipe. Next, centre-pop the top of the column, and drill a $\frac{5}{16}$-in. hole full length,

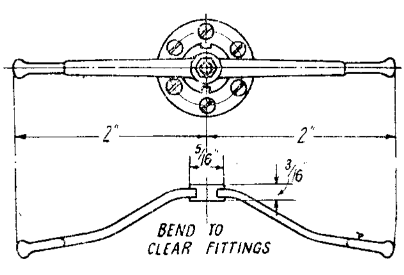


Regulator gland, handle, and stop

breaking into the tapped hole at the bottom. Open out the top for a bare $\frac{3}{16}$ in. depth, with 11/32-in. drill; tap $\frac{3}{8}$ in. by 40, and screw in a little brass plug. Either put a smear of plumbers' jointing on the threads, or solder over the plug, whichever you prefer. Chuck a bit of $\frac{3}{8}$-in. rod, and put a few $\frac{3}{8}$-in. by 40 threads on the end. Screw the casting on to this, by the steam-pipe boss; then face-off and centre the little boss on the opposite side, drilling a No. 30 hole in it for $\frac{3}{16}$ in. full depth. Take care not to pierce the steam-way in the column. Mark off the two ports, at $\frac{3}{16}$ in. from the edge of the circular boss, and on the centre line of the column. Drill $\frac{3}{16}$ in. and on the upper one cut a little angle in the right-hand edge, making the hole slightly pear-shaped. This is to allow a little steam to enter the pipe before the main ports come into action; it takes the place of a pilot-valve, and is useful for preventing slip when starting a heavy load on wet or greasy rails, allowing the pressure to build up on the pistons, instead of giving them a kick which sets the wheels spinning.

Chuck the valve casting in the three-jaw by the chucking-piece provided; face, centre deep enough to leave a countersink about $\frac{3}{16}$ in. across, and drill No. 30. Turn the outside to 1 in. diameter; then reverse in chuck, gripping by the edge, and either turn or part-off the chucking-piece. Drill two No. 13 or $\frac{3}{16}$-in. holes, corresponding with those in the valve-face, but leave them both circular.

The trunnion-pin is a $\frac{7}{8}$-in. length of $\frac{1}{8}$-in. rustless steel or bronze rod, with $\frac{3}{16}$ in. of thread on each end. Screw this into the hole in the port-face, put on the valve, and secure it with a brass nut, and a spring wound up from 22-gauge hard bronze or brass wire. Leave the final facing till last, before final assembly.



Alternative S.R. type handle

Links and Levers

The double-ended lever which actuates the valve is filed up from a bit of $\frac{3}{16}$-in. by $\frac{3}{8}$-in. brass rod, to the shape shown in the illustration. Drill a $\frac{1}{8}$-in. hole in the middle, and file or punch it square. Drill a No. 44 hole at each end, at $\frac{13}{16}$ in. centres, and tap 6 B.A. The two connecting-links are filed up from 3/32-in. by $\frac{1}{4}$-in. nickel-bronze or good-quality brass, and drilled No. 34 at $1\frac{9}{16}$ in. centres. Unless commercial screws in bronze or gunmetal are available, with a little "plain" under the heads, it would be advisable to make your own; ordinary screws are useless here. I make mine from $\frac{3}{16}$ in. phosphor-bronze. Chuck in three-jaw, turn down 9/32 in. length to a diameter that will just fit the holes in the connecting-links, and screw 6 B.A. When screwing, put a link on, and when the die comes up against the link, you've got sufficient thread to allow the screw to be tightened up, yet leaving the link free to move. Part off to leave a $\frac{1}{8}$-in. head, and slot it with a thin hack-saw.

Set the regulator-valve so that the ports are are half open, and then scribe a horizontal line across it. On this line, drill two No. 44 holes at $\frac{13}{16}$ in. centres, and tap 6-B.A. Now face the valve and port-face exactly as I described for slide-valves and so on; replace valve, put the stand back in the boiler, and put the screws in.

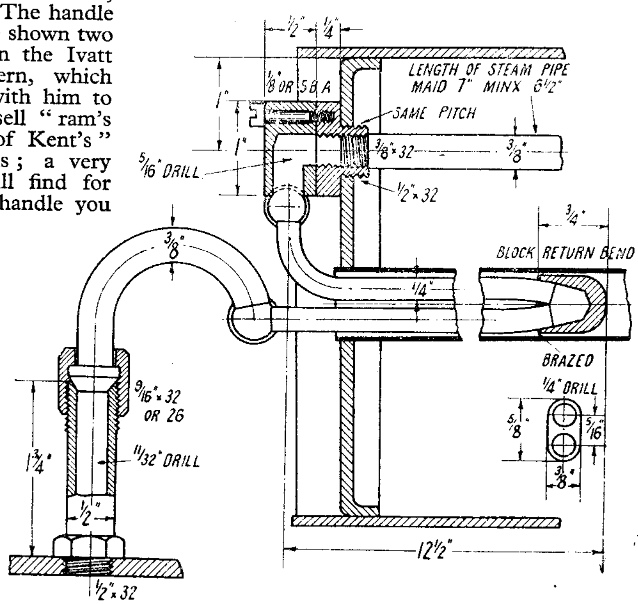
Rod, Gland and Handle

The regulator-rod is a piece of $\frac{3}{16}$-in. rustless steel, phosphor-bronze or nickel-bronze (German silver) rod approximately $13\frac{1}{4}$ in. long for "Maid of Kent" and $15\frac{1}{2}$ in. for "Minx." Chuck in three-jaw, and turn down a full $\frac{1}{8}$ in. of the end to $\frac{1}{8}$ in. diameter; then directly after this, file a square $\frac{3}{16}$ in. long, which will fit the hole in the middle of the double-armed lever. Turn the rod end-for-end, and turn down $\frac{3}{16}$ in. length to 3/32 in. diameter, screwing it 3/32 in. or 7 B.A. File a square 5/32 in. long, on that end also.

A casting with a chucking-piece will be provided for the gland fitting. Chuck in three-jaw, and turn the body to $\frac{1}{2}$ in. diameter and $\frac{5}{8}$ in. long. Face the flange, and turn the edge to 1 in. diameter. Reverse in chuck; cut off the chucking piece, face off, centre, drill through with No. 12 drill, open out to $\frac{1}{2}$ in. depth with letter "J" or 9/32-in. drill, and tap $\frac{5}{16}$ in. by 32. Drill six No. 34 holes around the flange. The gland is turned from $\frac{1}{2}$-in. round bronze, or a casting, same as piston glands. The handle can be any pattern you fancy. I have shown two here, the Marsh handle (same as on the Ivatt engines of the old Great Northern, which Douglas Earle of that ilk brought with him to the L.B. & S.C.R.) and the Maunsell "ram's horn" handle, which the "Maid of Kent's" big sisters sport on their backheads; a very convenient handle too, as users will find for themselves. The boss of whatever handle you choose has a square hole in the middle to fit the squared part of the regulator-rod; but don't file the square yet, as it has to be in relation to the position of the regulator valve, open or shut.

File or mill away $\frac{3}{16}$ in. length of the end of the gland fitting to form a step, as shown in the section; cut right down to the bottom of the hole. Now make a stop-collar $\frac{3}{8}$ in. long, from a piece of $\frac{1}{2}$-in. round brass, with a No. 13 hole through it, a tight fit on the regulator-rod; skim 1/64 in. off it, so that it will pass through the hole in the backhead. Sorry, I forgot to mention that this should be opened out with a $\frac{1}{2}$-in. drill. File or mill away $\frac{3}{16}$ in. of this also, to form a similar step to the one on the gland fitting, and put it on the regulator-rod approximately $1\frac{5}{8}$ in. from the handle end, as shown in the section.

Screw the two links to the double-ended lever, drop it down behind the regulator so that the square hole lines up with the little boss at the base of the column, and attach the links to the valve, as shown in the end-view. Insert the regulator-rod through the hole in the backhead, entering the spigot into the boss on the column, and the square into the double-ended lever. Put the gland fitting in place, with the step on it engaging with the projection on the stop collar; see section. There should be about 1/64 in. end-play of the regulator rod when the flange of the gland fitting is tight against the backhead; if more or less, shift the stop collar the necessary amount to ensure correct end-play, then pin it to the rod with a bit of $\frac{1}{16}$-in. bronze or rustless steel wire, pressed into a No. 53 hole drilled crosswise through the lot. Now turn the regulator to the "shut" position, shown in the end-view; hold it there with a tap-wrench on the end of the rod, then turn the gland fitting to the left, as far as it will go. Locate, drill and tap the screw-holes exactly as described for cylinder covers, and put one screw in, to keep the fitting from revolving whilst the "open" position is tested. Move the regulator to the "open" position, turning anti-clockwise, and when the stops meet, see if the holes in valve and port-face coincide fully. If they don't, file a shade more off the step on the gland fitting. When they do, the regulator is correctly adjusted. Put a 1/64-in. Hallite or similar joint-washer, or gasket, between the flange and backhead, and use 6-B.A. round-head brass screws with a smear of plumbers' jointing on the threads, to attach flange to backhead. Pack the gland



Details of superheater

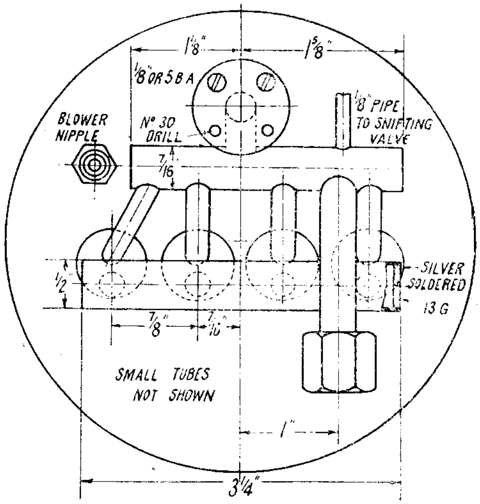
with a few strands of graphited yarn. The dome can then be put on with a similar gasket between the flanges, and the plug inserted in the oiling bush. File the square in the regulator handle, and fit it to the rod.

Many locomotives have the stops arranged outside on the gland fitting, which isn't so bad in full-size, but all those I have seen on little engines, so far, have been outsize and look just awful. Personally, I hate to see anything clumsy on a backhead, either big or little; and the stopless gland fittings on the old Brighton regulators, wanted some beating for absolute neatness. I always specify, and fit, inside stops.

Steam Pipe and Flange

The steam-pipe is a piece of $\frac{3}{8}$-in. by 20-gauge copper tube 7 in. long for "Maid of Kent" and $6\frac{1}{2}$ in. for "Minx." One end has a few 40-pitch threads on it (fine threads are desirable inside the boiler) and the other end is screwed $\frac{3}{8}$ in. by 32, same pitch as the tapped hole in the smokebox tubeplate. Put a smear of plumbers' jointing on both ends, and insert the fine-threaded end, through hole in tubeplate, into the boss at the base of the regulator casting. If you stick a round file in the end of the tube, it will screw home quite easily, and the file will release itself when reversed.

The flange will be a casting with a hexagon edge. Grip this in the three-jaw, turn down the boss to $\frac{1}{2}$ in. diameter, screw $\frac{1}{2}$ in. by 32, and face the shoulder truly. Face the end, centre, drill right through with letter R or 11/32-in. drill, and tap $\frac{3}{8}$ in. by 32. Reverse in chuck and face the end. Anoint the threads with plumbers' jointing, start it on the projecting end of the steam pipe, and screw home. The hexagon enables a spanner to be used, but don't overdo it and strip the threads.



Superheater headers

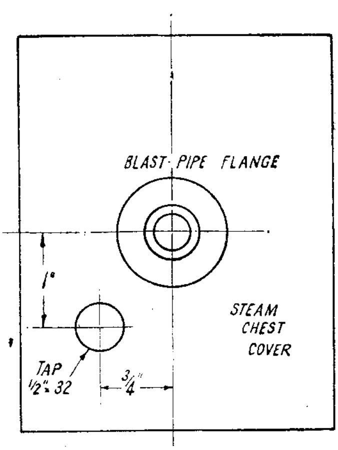
Superheater

The superheater really does superheat the steam, and not condense it, like the gadget. I scrapped on the commercial "Cock-o'-the-North." The flange is either a casting, or a $\frac{1}{2}$-in. slice parted off a piece of 1-in. brass rod. Centre, and drill $\frac{7}{16}$ in. deep with $\frac{5}{16}$-in. drill, then drill another $\frac{5}{16}$-in. hole in the side, to meet the centre one. Drill four No. 30 screw-holes as shown in the end-view. File a half-round recess in the side, across the hole, to take the wet header. This is a $2\frac{3}{4}$-in. length of the same kind of tube used for the fire-tubes in the boiler. Plug each end with a disc of 3/32-in. copper. Drill a $\frac{5}{16}$-in. hole $1\frac{1}{4}$ in. from one end. Drill four $\frac{1}{4}$-in. holes at the positions shown in the illustration, and a $\frac{1}{8}$-in. hole near the long end, for the snifting-valve pipe.

The hot header is a $3\frac{1}{4}$-in. length of $\frac{1}{2}$-in. by 20-gauge copper tube, with the ends plugged, four $\frac{1}{4}$-in. holes as shown for the ends of the elements, and a $\frac{3}{8}$-in. hole for the swan-neck which takes the hot steam to the union fitting on the steam-chest. The exact location of all the holes, is shown in the sectional and end-views. The reason for the wet header being arranged off centre, is to clear the union of the blower pipe, shown to the left in the end-view.

The elements are made from $\frac{1}{4}$-in. by 20-gauge copper tube, with block type return bends. The approximate length of the bent-ended ones is $12\frac{1}{4}$ in. and of the straight ones 13 in., but allow yourself a little latitude. The block return bends are made from little chunks of copper, $\frac{3}{4}$ in. long, $\frac{5}{8}$ in. wide and $\frac{3}{8}$ in. thick. Make two centre-pops on one end $\frac{5}{16}$ in. apart, and drill in on the skew-whiff, so that the holes meet, as shown in the section. Use letter "C" drill if you have one; in fact, use this for all the holes in the headers, as the pipes will then fit tightly, and "stay put" whilst being silver-soldered. Note—very important this—don't use silver-solder to fix the elements into the block bends; these must be brazed, using either soft brass wire, or Sifbronze. It only means getting pipes and blocks to bright instead of dull red. If you silver-solder the bends, they will soon give up the ghost, for when either "Maid" or "Minx" starts in to put her back into shifting a really big load, the inside of the firebox will be as hot as —well, a blast furnace, shall we say?—and it is advisable to take precautions!

I have shown a small swan-neck as the nearest way of connecting the header to the steam-chest, and having the union easily get-at-able through the smokebox door if necessary; but the pipe can have a big bend, and go right around the smokebox, if you find it difficult to make the short one. If the pipe is first well annealed, and then filled with melted lead, it will bend without kinking. In any case, the inside of the smokebox would be an unhealthy place for Inspector Meticulous to go snooping around in! The cone and union-nut need no detailing, as they are only slightly more grown-up editions of the little gadgets I have described so often.



Position of steam inlet on steam-chest cover

Experienced coppersmiths, or "locomotive plumbers" can assemble the lot as shown, and silver-solder all the joints at one fell swoop. This is O.K. for the smokebox end of the boiler. Beginners had better first tie the flange to the wet header, with a bit of thin iron wire, then put the bent ends of the elements into their respective holes, and allow about 6 in. of $\frac{1}{8}$-in.

(*Continued on page* 639)

IN THE WORKSHOP

by "Duplex"

*26—Lathe Filing-Rests

As has already been mentioned, a forked form of mounting for the guide rollers, as illustrated in Fig. 2, is required when filing a component carried between the lathe centres or when the tailstock is used to give support to the work. It was also pointed out that the lathe hand-rest, when attached to the cross-slide, could be employed to carry the fork assembly.

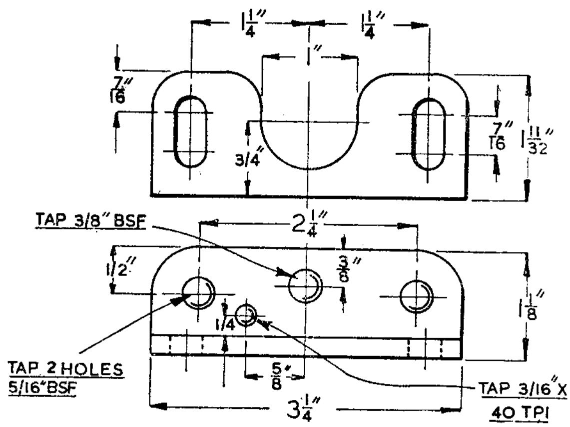


Fig. 11

Making a Forked Filing-Rest

The rest here described was made for use in connection with the Myford-Drummond lathe and hand-rest; and with it a flat of any required depth can be filed on a bar of 1 in. diameter mounted between the lathe centres.

The fork member shown in the working drawings in Fig. 11 is best made first. This part is constructed from a piece of angle-iron of sufficient width and thickness to hold up to the dimensions given.

Although the two limbs of this angle material do not always form a true right-angle, it will be sufficiently accurate to allow all the marking-out and drilling work to be undertaken before the faces are finally machined square.

After the material has been cut off and filed to length, the marking-out operation is carried out on the surface-plate with the aid of the surface-gauge, and in accordance with the dimensions given in the drawings.

In addition to the construction holes, it will be seen that two holes are drilled and tapped $\frac{5}{16}$ in. B.S.F. in the base to take studs or bolts as a temporary measure for mounting the work in the lathe.

At this stage, the holes to receive the pivots of the guide rollers are drilled with two $\frac{5}{16}$ in. diameter holes apiece, and these are then filed to shape to form the pivot slots, which enable the rollers to be adjusted vertically.

The fork aperture is cut to shape with hacksaw and file, for it is hardly worth while machining this profile in the lathe, although this can easily be done later if preferred.

The hole to receive the fork shank is drilled 21/64 in. and tapped $\frac{3}{8}$ in. × 25 t.p.i., or any other pitch of thread can be used if screwing tackle of this size is not available; in addition, the hole for the adjusting screw is drilled with a No. 20 drill and then tapped $\frac{3}{16}$ in. × 40 t.p.i.

The material of which the angle-iron is made may be found peculiarly tenacious, and great care must, therefore, be taken when tapping the holes to maintain the tap truly vertical to the surface by constantly checking it with a small square in two directions at right-angles. Any burrs formed by the drilling and tapping should be removed by rubbing the work on a large file in order to form the flat bolting surfaces required for the machining operations that follow. The next step is to true the faces of the angle-iron, and also the abutment faces for the pivots, by turning operations in the lathe. For this purpose, the work is bolted to an angle-plate attached to the lathe faceplate as illustrated in Fig. 12; and to secure the fork, either short studs can be screwed into the fixing holes already described, or, if preferred, hexagon-headed screws can be inserted from below.

As shown in the drawing, a parallel distance-strip is used to set the work parallel with the surface of the faceplate, and it is advisable to locate the aperture of the fork approximately central in order to lessen the amount of machining required. Unless the back-gear is used, it is essential to bolt a balance-weight to the faceplate so that, with the driving belt free, the mandrel has no tendency to set in any one position. One of the lathe change-wheels will serve well for this purpose.

It may be found that the particular material used is difficult to turn to a good finish, but the sample of angle-iron from which the fork was made was successfully machined at a moderately high speed of rotation with the aid of a tool tipped with tungsten carbide, and moreover, this tool was quite unaffected by the hard scale present.

When one face of the fork has been finish-turned, the work is bolted to the angle-plate in a similar manner for machining the under surface of the base, but in this case bolts passing through the pivot slots are used to secure the work in place.

*Continued from page 590, "M.E.," December 2, 1948.

The final turning operation consists in reversing the work on the angle-plate for machining the abutment faces for the pivots.

As shown in Fig. 13, the fork is clamped in place by means of a single bolt passing through the shank hole, but greater security will be obtained if a stud is screwed into the fixing hole provided and a nut is applied on the under side; at the same time, the work is set parallel to the faceplate with a distance-piece, and the pivot slot is located approximately central by means of a rod held in the tailstock drill-chuck. The facing operation is carried out with a small boring tool to a depth of, say, ten-thousandths of an inch to form a flat, circular area of some $\frac{7}{8}$ in. in diameter; the readings of both the cross-slide and leadscrew index must be noted so that these dimensions can be exactly repeated when the second pivot abutment surface is machined after the work has been reset in a precisely similar manner.

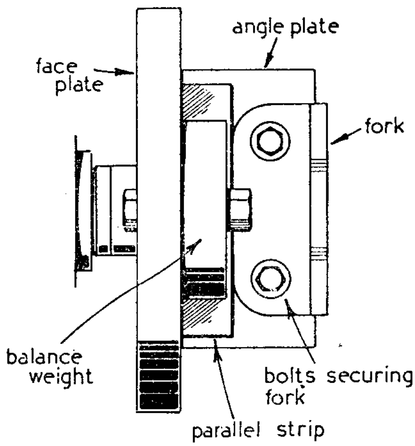


Fig. 12

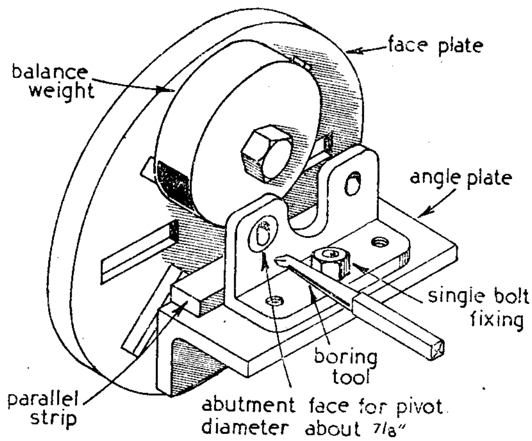


Fig. 13

This completes the machining of the fork member, and, if the work has been accurately carried out, it will be evident that when the rollers are fitted in place they will stand truly parallel with the base, and, at the same time, their guide flanges will be exactly in line.

The large machined surfaces can, if desired, be finished by scraping to remove the tool marks, and the unmachined parts may be either filed or painted to give a satisfactory appearance.

Machining the Fork Shank

The shank, shown in Fig. 14, which is next taken in hand, is machined from a length of $\frac{3}{4}$ in. diameter round mild-steel to a good sliding fit in the base of the hand-rest; and at the same operation the end is reduced in diameter and then threaded from the tailstock to fit the hole already tapped in the base of the fork. When threading a part such as this from the tailstock, it may be found that the work is liable to turn in the chuck, and rather than strain the chuck by over-tightening it, the rod should be removed from the lathe and gripped in the vice, for if the die has been given a true start it should continue on a straight path when carefully turned by hand.

If much resistance is encountered when cutting short lengths of thread with the aid of the tailstock die-holder, the work can be conveniently rotated by means of the chuck key inserted successively in the key slots; this relieves the mandrel of strain and prevents the chuck unscrewing when the motion is reversed. After the shank has been parted off to the correct length, it is reversed in the chuck for facing and chamfering its lower end.

It now remains to machine the flat on the shank for maintaining the fork at all times in its correct position across the lathe axis.

To enable the flat to be marked-out correctly, the shank is screwed home in the fork member and then inserted in the hand-rest base; the base is set in the position it will occupy in use on the cross-slide, that is to say with the long side of the sole at right-angles to the lathe axis and with the clamp bolt conveniently placed for tightening with the right hand.

The fork is now turned until it, too, lies directly across the lathe in the position used for filing operations; the vertical centre-line of the flat in relation to the clamp-bolt is them indicated with a scriber mark. It is, however, advisable to make a small allowance for the draw in the thread that will inevitable take place in the course of dismantling and re-assembling the parts.

The marking-out of the lateral dimensions of the flat can then be completed with the aid of a key-seat rule, and its upper limit is scribed with the jenny callipers in accordance with the working drawing. As the position of the fork when the rest is in use is determined by the flat, it is important that this should be accurately machined, preferably by a simple milling operation. For this purpose, the shank is mounted in the machine-vice attached to the vertical milling slide as shown in Fig. 15. The vertical slide is set so that the fixed jaw of the vice lies horizon-

tally and the surface of the work is at right-angles to the lathe axis; both these adjustments can be readily made with the aid of the test indicator attached to a spindle gripped in the lathe chuck, as has been described in previous articles.

The actual milling is carried out with either an end-mill, a facing milling-cutter; or, if these are not available, a fly-cutter will serve the purpose when used in the manner described in the article dealing with fly-cutting in the lathe.

The work is set to the lathe centre height and, after the vertical slide and the lathe saddle have been locked, a succession of light cuts is taken as far as the end limit mark, using the cross-slide feed and putting on the fresh cut with reference to the leadscrew index. These operations are continued until a flat of approximately $\frac{5}{16}$ in. in breadth has been formed.

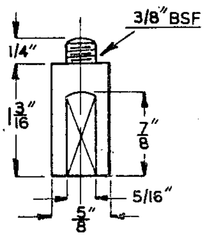


Fig. 14

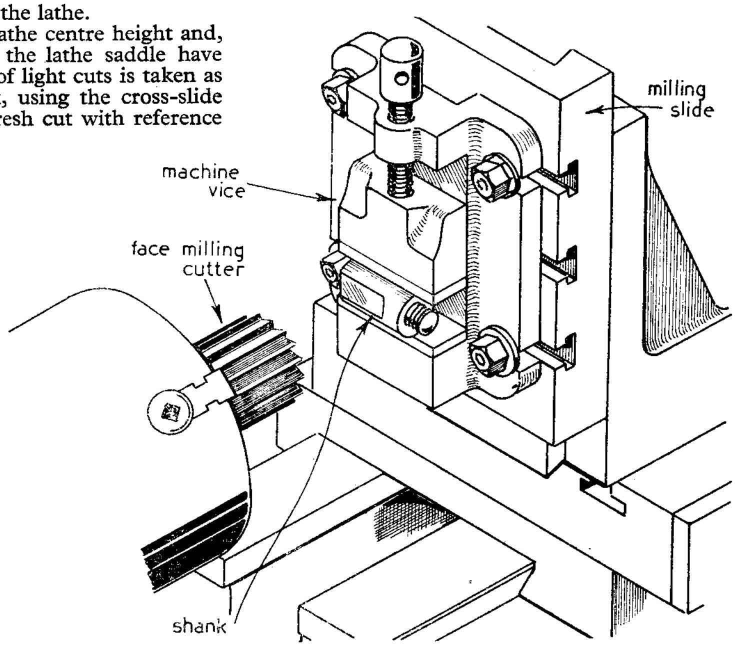


Fig. 15

After removal of any burrs with a fine file, the machining of the shank is complete and it can be screwed firmly home in the fork.

Height-Adjustment Mechanism

As will be apparent in the drawing in Fig. 16, the height of the roller-fork is adjusted by means of a screw turning in the threaded hole in the base of the fork, and bearing against the upper surface of the lug on the hand-rest base illustrated in Fig. 2. The obvious alternative method of adjustment is to cut a screw thread on the upper end of the shank, and to fit to it a knurled and graduated finger-wheel; but there is very little overhead room in the space available, and some may prefer to avoid, if possible, machining the internal and external screw threads necessary for accurate working. Nevertheless, the working drawings for fitting this form of adjustment are given in Fig. 17 as a guide to those who wish to adopt it.

If a thread of 1/20 in. pitch is used and the finger wheel is graduated by indexing it to 10 divisions, each division will then represent five-thousandths of an inch of vertical movement which should enable settings to be made sufficiently exact for most purposes.

Although the finger-wheel is only $\frac{1}{8}$ in. thick, in practice it is used merely as a setting collar and has but little resistance to overcome.

When this form of adjustment is adopted, the hand-rest itself should be mounted on a spigot turned while gripped in the lathe chuck; the upper surface of the rest is then faced flat to afford a true bearing for the finger-wheel.

On the other hand, the adjusting screw shown in Fig. 16 is easily fitted and readily turned with a screwdriver when setting the height of the rest; in practice, this arrangement has been found quite satisfactory. In any case, when it is necessary to file to an exact dimension, the micrometer should always be referrred to for the final check. The test indicator, mounted on the pillar of the surface gauge and standing on the lathe bed, can also be employed, both to set the height of the rollers and to determine the amount of material removed during the filing operation.

As the hexagon-headed screw fitted has a pitch of 1/40 in., a complete turn will move the rest 25 thousandths of an inch, and turning the screw from one corner to the next will represent approximately four thousandths, or rotation from a corner to the following flat will indicate very nearly two thousandths of vertical movement.

The screw can conveniently be machined from a length of 4 B.A. hexagon rod which is threaded from the tailstock and has its tip faced flat and then chamfered. To allow a screwdriver to be used for making adjustments, a slot is cut across the head of the screw with a fine hacksaw.

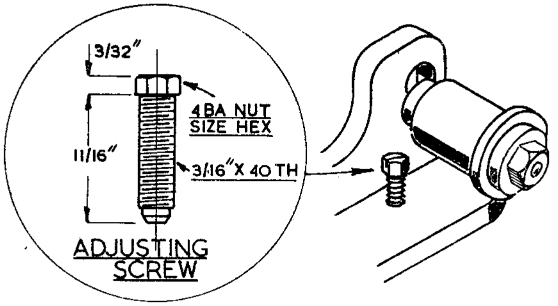


Fig. 16

the screw is gripped in the chuck and the pad is faced flat.

The complete filing-rest can now be assembled and if it is found that the allowance made for draw in fitting to shank to the fork has been excessive, then the shank should be removed and again gripped in the chuck to enable a small amount to be turned off the abutment face in order to bring the parts into the correct position. It should be borne in mind that the removal of 10 thousandths of an inch in the case of a screw of 26 t.p.i. will represent approximately a quarter turn.

The Clamping-screw

It is essential that the clamping-screw, fitted to the hand-rest lug, should be accurately made so that it registers truly with the flat formed on the shank, and thus ensures that the fork is always correctly located.

As shown in Fig. 18, the end of the hexagon-headed screw is reduced in diameter at its tip to obliterate the threads, and after it has been faced flat it is drilled axially to receive the shank of the brass pad-piece illustrated. The pad should be a light press fit in the end of the screw; and when it has been pressed into place in the vice,

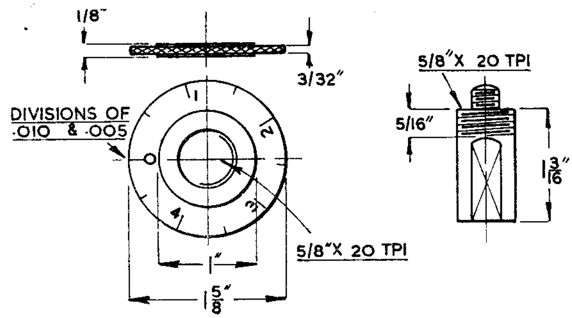


Fig. 17

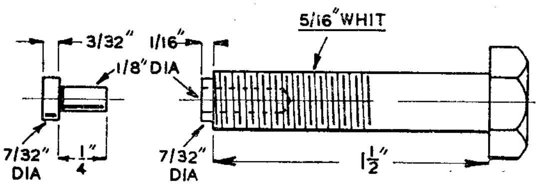


Fig. 18

When the filing-rest is mounted on the cross-slide, the hand-rest base is set to bring the guide flanges of the rollers exactly square with the work; this can be readily done by holding a rule against the flanges and bringing it into contact, either with the chuck or with the face of the work as represented in Fig. 4.

"L.B.S.C."

(*Continued from page* 635)

copper tube for the snifter pipe. Silver-solder that little lot, and don't forget the ends of the header. Then fix the union cone on the swan-neck; assemble the bottom elements into the hot header, along with the other end of the swan-neck, and silver-solder that instalment. A one-pint blowlamp will do the lot easily. Pickle for about ten minutes, then wash off, and let the water run freely through the whole lot. The flange is attached to its mate on the steam-pipe by four $\frac{1}{8}$-in. or 5-B.A. screws, with a gasket of 1/64 in. Hallite or similar jointing between the faces.

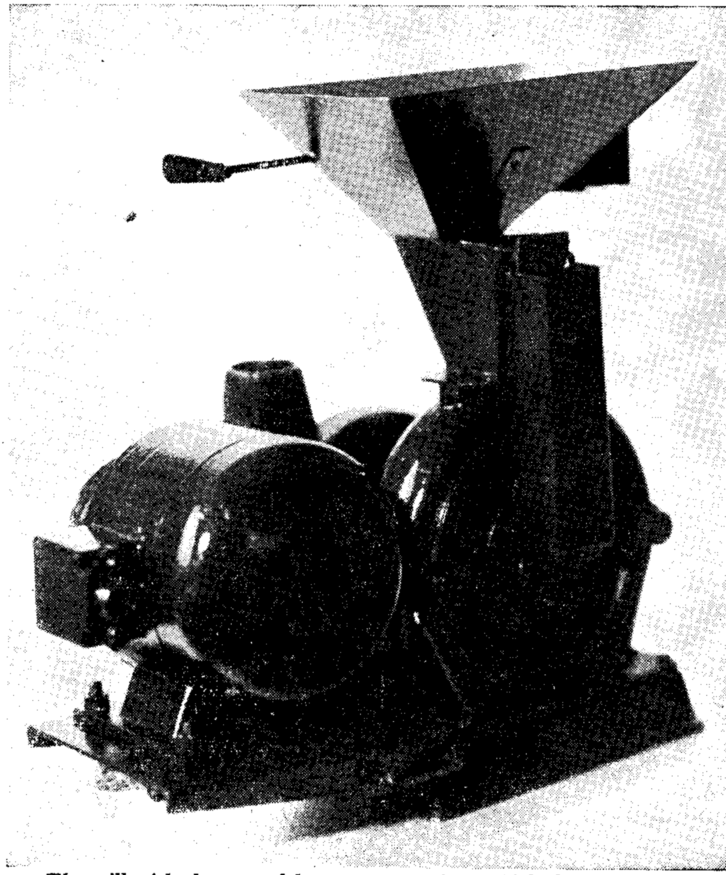
Connection to Steam-Chest

This is the same on both "Maid" and "Minx." Drill a hole in the top cover of the steam-chest $\frac{3}{4}$ in. ahead of the blastpipe flange centre, and 1 in. off centre-line of engine; see plan. You had better take off the cover for that job, in case any chips get inside. Use 29/64-in. drill, and tap $\frac{1}{2}$ in. by 32. If a casting isn't available for the fitting, use a bit of $\frac{5}{8}$-in. hexagon rod, about 2 in. long; face one end, centre, and drill right through with 11/32-in. drill. Turn down $\frac{1}{4}$ in. length to $\frac{1}{2}$ in. diameter, and screw $\frac{1}{2}$ in. by 32, then face off $\frac{1}{16}$ in. so as to get full threads to the end. Reverse in chuck, turn down $\frac{1}{2}$ in. of the end to $\frac{9}{16}$ in. diameter, and screw $\frac{9}{16}$ in. by 32 or 26, to suit the union nut on the swan-neck. Reduce the rest of the length to about $\frac{1}{2}$ in. diameter, but leave enough of the hexagon to allow for a spanner grip when screwing the fitting home. Anoint the threads with plumbers' jointing. Put the boiler temporarily in position to see if the pipes line up all right; but the permanent connection will not, of course, be made until the boiler is erected "for keeps." Next stage, connections for outside cylinders.

A Model Hammer Mill

by

E. M. Ackery



The mill with the control hopper on top, into which the grain is fed

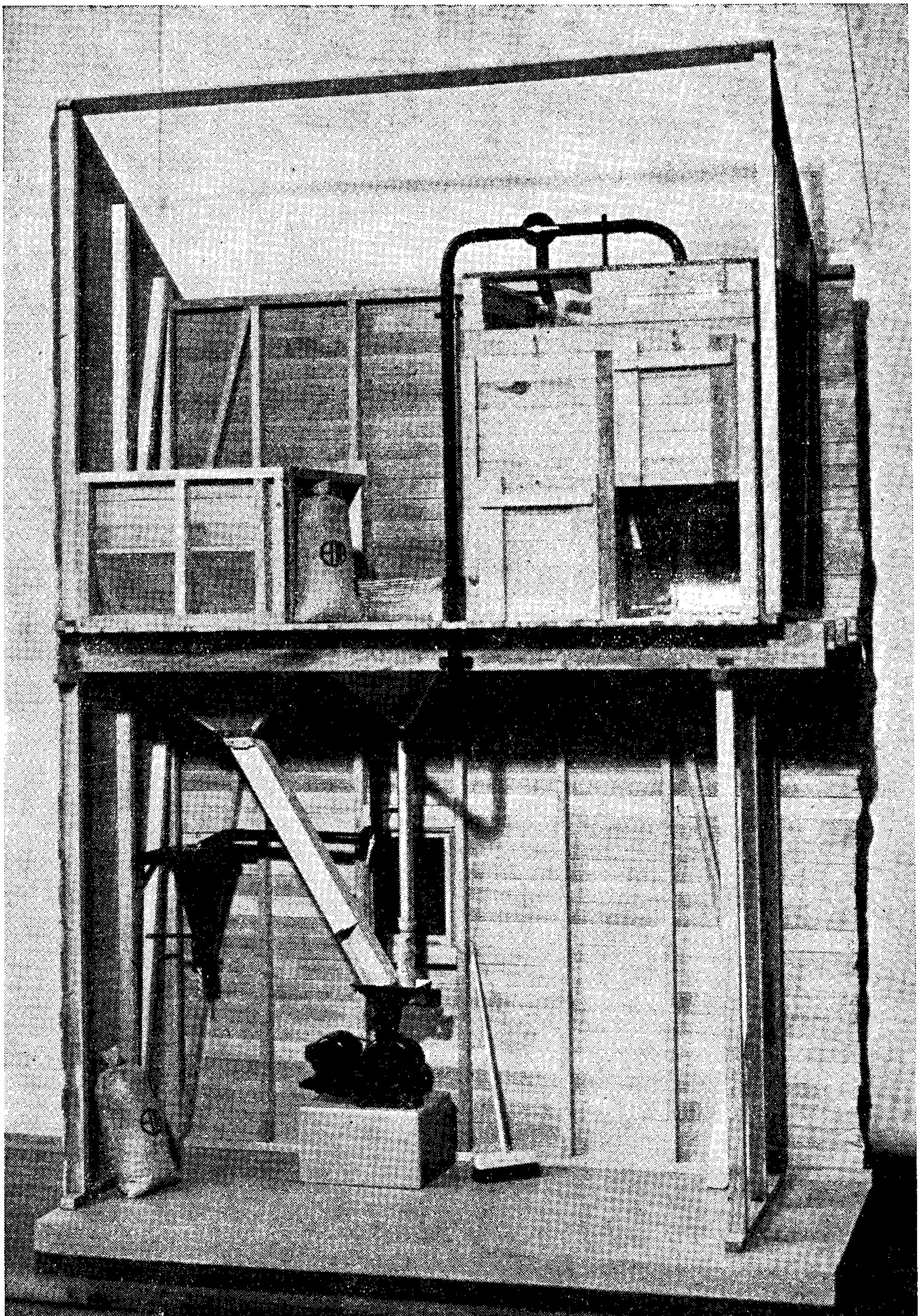
THIS is a rather unusual type of model, built to a scale of 2 in. to 1 ft., which I recently constructed for exhibition purposes, to illustrate to the farmer how such an installation should be laid out to give the maximum convenience and labour-saving.

Some details of the prototype which this model represents may be found of general interest. Before the war, the only mill available for the farmer who wished to grind his own meal was the plate mill. The latter, however, suffers from the disadvantages of requiring a very large motor to drive it, i.e., something in the neighbourhood of 20 h.p.: of requiring constant attention while it is running, as if it runs "dry," it will overheat and cause damage; and in general, it requires considerable skill on the part of the operator to obtain the required fineness of grinding.

During the war, a considerable amount of experimental work was done with the idea of producing a low-priced mill that had a moderate power demand, and which would be entirely automatic in operation. The type of mill that emerged as the result of these experiments was the so-called "Hammer Mill," in which the meal is ground by a rotor revolving inside a cylindrical screen. In many cases, this rotor had swinging hammers on the end of its fingers; hence the name "Hammer Mill." The action of the mill is to disintegrate the grain rather than to grind it.

The Electric Supply Industry is keen on the idea of using these mills, because, owing to their low power requirements, they do not aggravate the "Peak" problem in the same way as the high-powered plate mill does. From the farmer's point of view, he gets a cheaper mill, one that can be entirely automatic in operation, and a job that, in some cases, will lead to lower electricity charges, particularly in those cases where he pays for his electricity on a maximum demand tariff.

The mill and electric motor, shown in the close-up photograph, are built up from stock raw materials, mostly brass rod, and no castings are employed. All details of building, mill and accessories are to scale, and the model represents about 180 hours' work. At present, it is non-working. Though the motor houses a "Rev" motor and will run, it has not enough power to turn the mill pulley. Later, it is hoped to make it a working model in the sense that grain, represented by small seeds, would flow into the mill from the feed hoppers and disappear through the mill into a container below, the motor being controlled by a time-switch or by the automatic flap-switch in the mill hopper. Such mills are used by farmers for grinding meal for feeding cattle, pigs or poultry.



The complete installation, showing the mill and cyclone for direct sacking of meal on the ground floor, with the grain and mill storage bins upstairs

Automatic Expansion Control for Locomotives

by G. Rhodes

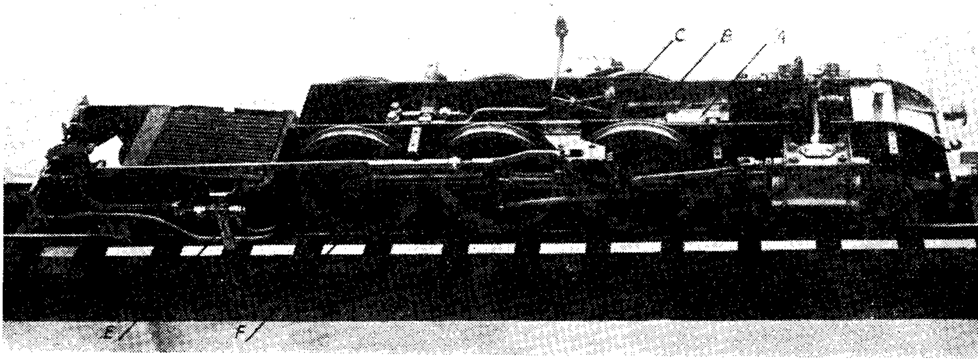
As The Model Engineer so ably brings to our notice week by week, there is a fascination about steam locomotives, whether large or small, shared by old and young alike. This would seem even today to compare more than favourably with any other form of transport or mechanical motion. See the interest displayed at any public show in the running of a model steam railway. Replace the steam engine by a clockwork or electric train, and although there may be the parodying of all the motion, interest at once slackens, and the front seats are left to the children.

There is a further fascination but in which the looker-on cannot get the same thrill, and that is in the building of the model. Witness the excitement of the builder on his first try-out, and his satisfaction at the the first turn of the wheels. The looker-on can be interested in the very fine workmanship so often put into a model, or in the faithfulness of reproduction to the prototype, but no doubt, the greater interest is in the running, even for the builder.

Apologising for this preamble, I approach my subject, and that is the running of the engine. Owing partly to lack of experience, I have found difficulty in controlling the engine on the track, resulting in several major disasters which, although not without humour, can be really serious and emulate those in full scale " practice " necessitating many hours of work in repairs. This is where it is difficult to see the humour, especially by the friend whose rolling-stock one has borrowed. In one instance, on a 60-yd. continuous track, the regulator was missed on the first circuit when it was seen that the speed was getting " out of scale," and although the engine kept the track, some 20 coaches and trucks left the rails and were scattered like a tin can attached to a dog's appendage.

Again there is a difficulty in starting, and that is in having to set controls as near as one can for the general running, linking up, opening the regulator the right amount only which requires one to give a little but not too obvious aid in getting under way. Even so, steam is apt to build up, condensate clears and, with the driver absent, the " gremlins " take charge, leaving the pieces to be picked up.

With the urge of these difficulties, I devised an automatic control not only to overcome the above troubles but to emulate as much as possible the characteristics of full-scale driving. The control can be pre-set to the desired speed, and the engine can be started in full gear and on full steam. The maximum starting effort is thus obtained and the control, working on the expansion, links up as the speed increases. After a few yards, or when the pre-set speed is reached, the train settles down to its " block " speed, the expansion being controlled to meet variations in load and gradient.

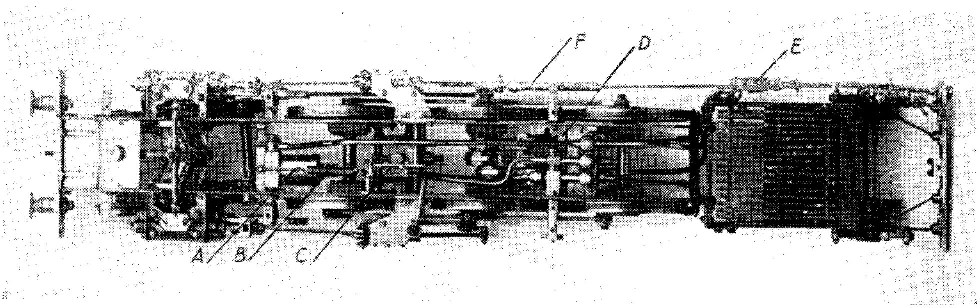


The starting under full steam and full gear with a heavy load and on gradients is most attractive and realistic. With the load approaching the adhesion limit of the engine and on slip occurring, the racing is immediately checked as in full-scale driving practice, and as grip is secured the steam is again at full blast. Variations in the exhaust on gradients gives an impression of life on the engine, and the climbing of up-gradients is reminiscent of Shap.

Under the conditions of control by linking-up and with full regulator, the maximum expansion of the steam is obtained, the aim of all good steam control, which should result in a considerable saving in steam. An admittedly rough check was made by seeing how far the engine would run at one firing with, and then without, the control in action. The load and track were the same, and the speed without control was adjusted to be as near as possible the same by linking up as much one would do to get a start and by the regulator. The result was that under automatic

control the train ran 1,300 yds. against 800 yds. without.

On the first trial of the engine with the control, I was surprised to find that, although the gear was fully linked-up, it still reached too high a speed for the track, and it had been my impression that whatever the lead, an engine would not run in neutral. The lead was, I imagine, about normal for this type, 15 deg. The lead has been reduced to about a half, but even now it pulls a train of some 100 wheels at scale speed fully linked up.



The engine is a 2½-in. L.N.E.R. Pacific, coal-fired. The principle of the control is quite simple. It is by means of an hydraulic system acting on the valve-gear weighshaft, through a centralising linkage bringing the gear into the neutral position, the degree of centralisation depending on the rate of delivery of a force-pump against pre-set leakage, the amount of leakage determining the speed of the engine. The hydraulic actuating piston is spring-loaded so that the position of the piston and the corresponding amount of linking up is dependent on the balance of the hydraulic pressure against the spring loading.

The control requires the following parts and modifications :—

A force-pump similar to but, perhaps, smaller than the boiler feed-pump.

A single-acting hydraulic cylinder, spring-loaded to return piston.

Centralising linkage connecting between valve weighshaft and hydraulic cylinder.

An adjustable relief-valve connected to a lever or screw set in a convenient position in the cab.

Modifications to existing mechanism consist of fitting a lever to the valve weighshaft and interposing a double-acting spring jigger in the bridle-rod of the valve-gear.

The photographs show the adaptation of the control to a 2½-in. gauge L.N.E.R. type locomotive. The key to the parts is as follows :—

A, the hydraulic cylinder.

B, the spring loading for A, which is adjustable.

C, the centralising linkage acting on the valve weighshaft.

D, the force-pump. In this case, the pump is one of a three-throw unit, the other two being for the boiler feed.

E, the relief-valve. The control lever for this is mounted concentrically with the reverse lever in the cab. This makes a neat and very convenient position and is appropriate as its function is closely associated with the valve control.

F, the spring-jigger. This is so made that under normal conditions, the bridle-rod acts as a solid rod, but when the expansion control comes into operation permits the reverse lever setting to be over-ridden. The jigger also acts in conjunction with the spring on the hydraulic cylinder in bringing the gear back into position as set by the reverse-lever.

The control works equally well in forward or reverse, and it was in obtaining this desideratum that a good part of the scheming was called for. The centralising linkage was the answer. As may be seen in the photograph, this consists of two links connected top and bottom to the lever actuated by the hydraulic cylinder ; the other ends of the links which are slotted to a common pin on the valve weighshaft lever. When the control is not in operation the slots permit full travel either way of the weighshaft. As the control comes into operation, the links travelling in opposing directions, centralise the weighshaft and so bring the gear into neutral.

The control lever acting on the relief valve varies the opening in the valve by a needle, so made that in the back position the valve is practically closed and in the forward position fully open and so putting the control gear out of action. The mid-position of the lever is set by means of the adjustable spring on the hydraulic cylinder so that the engine will run at its scale speed. When the valve is open the engine is free to be operated in the normal manner, the automatic expansion control being out of action and in no way interfering with the running of the engine.

The hydraulic system is a closed circuit taking water from the common supply pipe from the tender, the leakage from the relief-valve being fed back into the pipe. There may also be a small leakage from the hydraulic cylinder which can also be fed back. It is desirable that there should be no undue friction in the movement of the hydraulic piston, so the piston is not packed ; but a packing gland is provided for the rod. In practice, it has been found that the leakage is so small that no return pipe has been fitted nor has the gland been packed. The leakage itself is not important, as there is always leakage through the relief-valve, the whole supply to the system, of course, must leak back.

The maximum working pressure rises to about 5 lb. per sq. in., dropping to nothing on full gear. On the average, this means that the control absorbs about 1 ft./lb. in 150 yds., an amount, according to the rough check, repaid a thousand times by the steam saved.

A WOODEN LATHE STAND

by R. E. Blakeney

AFTER months of cogitation, weighing up the pros and cons of various makes and, what was far more important, reviewing the budget, a new lathe was eventually ordered. The most optimistic delivery promised was three months for the particular make which had been chosen. It was realised that this seemingly endless period would pass a little less slowly if some preparation were made for the arrival of the lathe.

Having had some experience of stands fabricated from angle-iron, it was decided to make the new one of wood, and to fit it with a couple of drawers to hold the usual tools and attachments used with a lathe. A visit to the local timber-yard soon made it obvious that the stand could not be built at one go, because the amount of material required exceeded the monthly allocation of £1's worth of timber. However, this was accepted as just another sign of the times, and the first part of the order was placed there and then.

It had been decided to construct the top of the stand of 9 in. × 2 in. "prepared," and for the benefit of those who have not bought much wood, it is as well to remember that any timber ordered as "prepared" is usually about ⅛ in. under size. The legs, cross-pieces and brace were to be 4 in. × 2 in., and acting on the advice of the timber merchant, the inner edges of the top pieces were tongued and grooved. As we all know by now, most home-grown timber is kiln dried or seasoned very rapidly, with the result that, if left to its own devices, it almost goes round corners while one waits. The tongue and grooves were intended to reduce the chances of warping, but this turned out to be just a pious hope. A certain amount of work was saved by ordering all the 4 in. × 2 in. cut to length, but an in. or so was allowed for squaring up the ends. To make the construction simple, and to permit the bench to be dismantled should it ever be necessary, all joints were made with ⅜-in. hexagonal bolts.

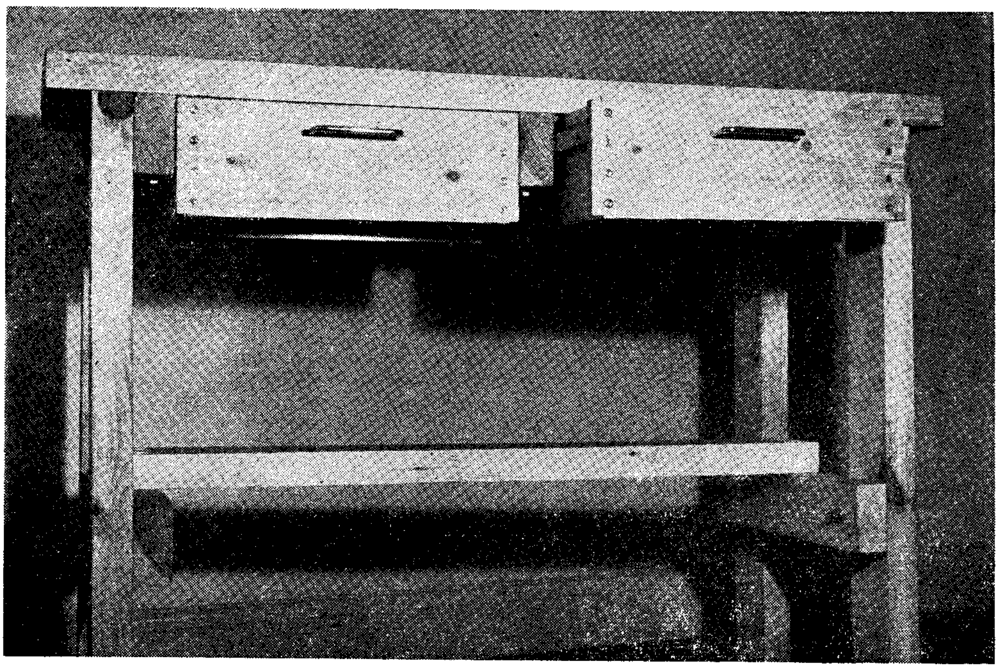


Photo No. 1. The completed lathe stand, showing its construction

A start was made on the top by squaring up the ends and marking out the centre-lines for the bolt holes. Before the holes were drilled, recesses were formed for the bolt-heads with a 1½-in. cutter, which was followed up with a 25/64-in. drill. The cross-pieces were then marked off from these holes, and afterwards drilled right through. When all the holes had been drilled, the top of the stand was assembled, using machined washers under the bolt-heads and

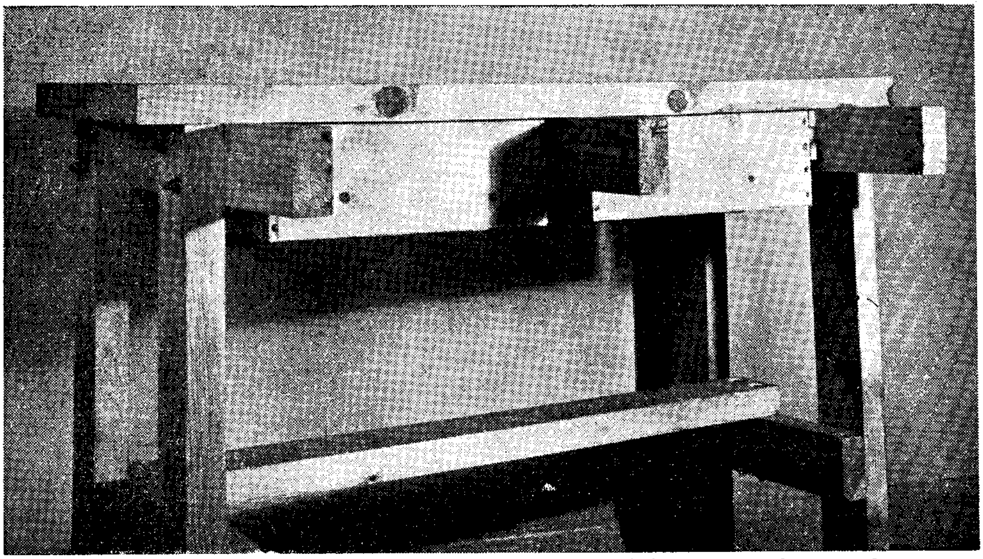


Photo No. 2. Showing how the cross-pieces are extended to the rear of the stand

the nuts. Where a recess has to be formed, do not make the mistake of drilling the 25/64-in. hole first; it is quite easy to do, but means that one has to plug the hole before the $1\frac{1}{4}$ in. cutter can be used.

The ends of the legs were next squared up, and some trouble was taken to see that they were really square. The bolt holes were then marked off and drilled, and used as jigs for marking off the corresponding ones in the cross-pieces underneath the top of the stand. The latter were then unbolted from the top planks, recessed on the insides and drilled for the bolts. Having got as far as this, the whole thing was re-assembled stood up the right way and admired. How difficult it is to resist the temptation to "see what it looks like." Unfortunately, the floor was not exactly level, which had a somewhat salutary effect. However, it was eventually to be bolted down, so fresh heart was taken and the job

(*Continued on page* 647)

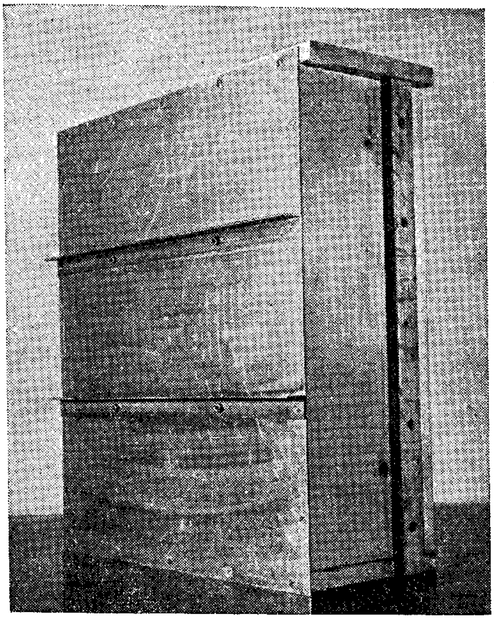


Photo No. 3. A completed drawer, from which can be seen the angle brass supports

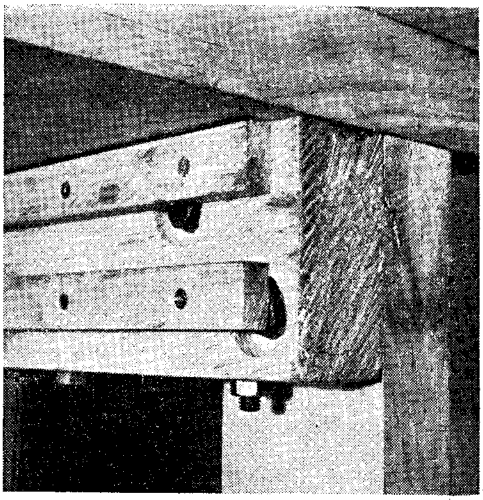
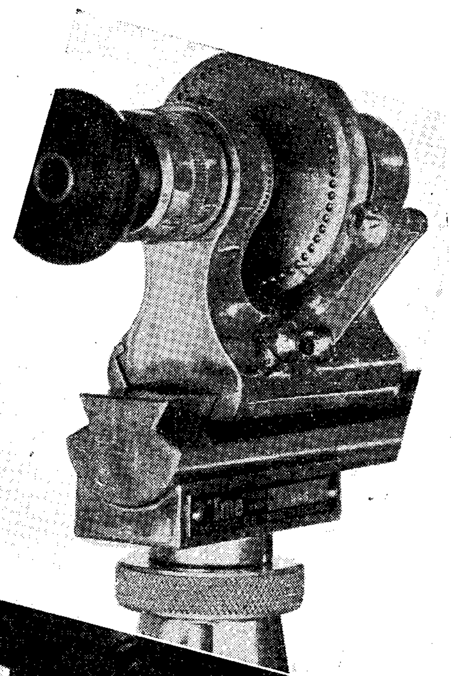
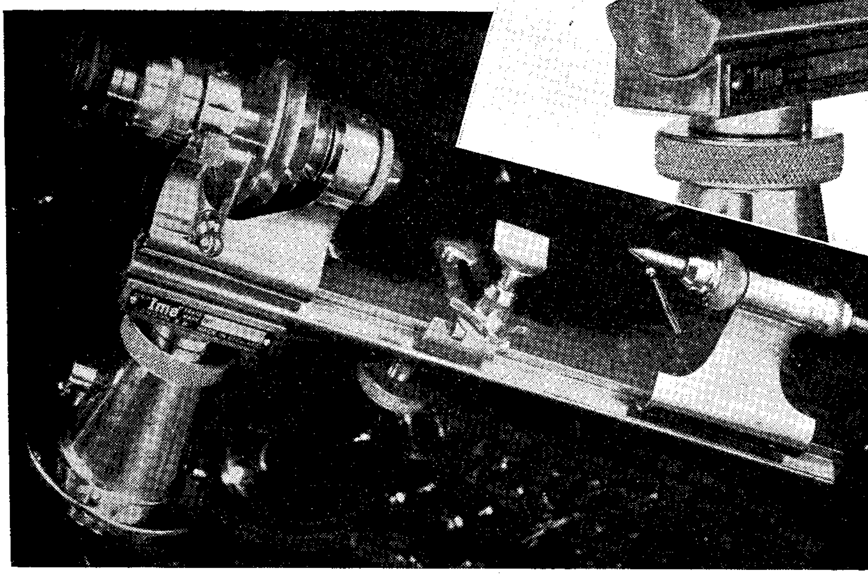


Photo No. 4. The drawer guides, and method of recessing the bolt heads

The "Ime" Watch and Instrument Lathe





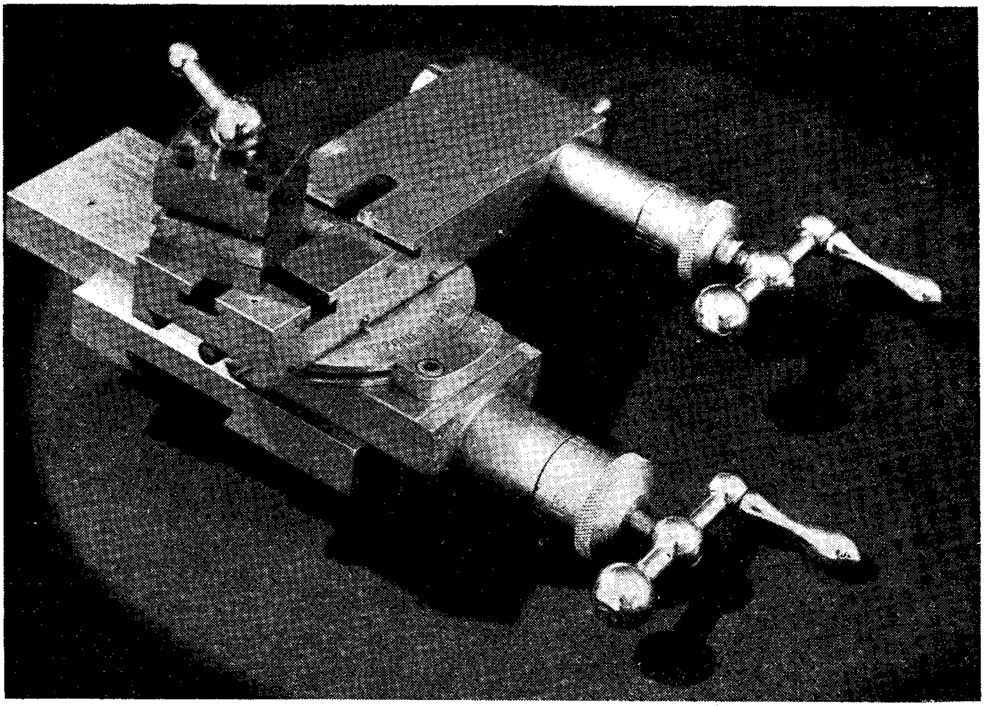
The " Ime " watch and instrument lathe, and above—view showing headstock and end of bed

WE have received from the Ideal Machine Tool and Engineering Co. Ltd., 2828, Kingsland Road, London, E.8, particulars of this new lathe, which embodies a number of very interesting and original features. Among these may be mentioned the unique shape of the bed, which combines the best features of established watch lathes, and is sufficiently rigid to maintain accuracy under all working conditions.

The headstock and tailstock are line-bored and ground at one operation to ensure perfect alignment. Hardened and ground conical bearings are fitted to the headstock, and embody the usual methods of endwise adjustment to take up play. After assembly, the headstock spindle and tailstock bushes are ground on a master bed to ensure perfect concentricity. The draw-in spindle for operating the collet chuck has a hardened and ground renewable conical seating, fitting into a cone at the rear of the headstock spindle, thus eliminating side play and wear. Spring-loaded ball lubricators are fitted to the headstock, also dust covers in the front and rear, and oil-retaining felt washers to give protection to bearings. The headstock and tailstock clamps extend the full length of each component, and are tightened on the bed with the minimum effort on the clamp-screw. The headstock pulley is indexed and an adjustable spring-loaded pin is fitted on the front of the headstock.

A compound slide-rest is available as an extra item of equipment, and among its distinctive features may be mentioned the fact that both handles can be operated from the front ; also, that the slide screws run in adjustable ball-bearings, and backlash can be taken up by adjustable bronze compensating nuts. The top-slide swivels and is graduated for taper turning, and both screws have graduated indices.

A contracting chuck is fitted to the tailstock



The compound slide rest

to lock the tailstock barrel. A somewhat similar method of clamping the T-rest column is fitted, and in addition to the usual sliding and swivelling adjustment to the foot of the rest, it is provided with a tip-up hinge, enabling it to be turned down out of the way when not in use.

A number of accessories are available, including a tailstock drilling attachment, safety pulley attachment for headstock, self-centring drilling attachment, and various other items.

The dimensions of the bed are 10 in. long (254-mm.), $1\frac{1}{8}$ in. wide (28.5-mm). The swing over bed is $3\frac{1}{8}$ in. (80-mm.) and the headstock spindle is bored to take 8-mm. split chucks. Each lathe is tested at a speed of 5,000 r.p.m. for eight hours, and a testing sheet is supplied with each machine.

The standard outfit consists of a polished mahogany case containing the bed with adjustable swivelling foot, headstock with a draw-in spindle, tailstock with male and female runner, and "tip-over" type hand-tool rest.

A Wooden Lathe Stand

(*Continued from page* 645)

continued. The cross-pieces between the legs, and the brace between them, were marked off and drilled as before, and the whole bolted up.

From photograph No. 2 it will be seen that the cross-pieces beneath the top of the stand have been allowed to extend beyond the back of the top planks. This was done so that at some later date it would be possible to mount a length of shafting in plummer-blocks, and provide an independent drive for milling or drilling.

As will have been gathered by now, the writer is no carpenter, and the prospect of making and fitting conventional drawers did not appeal at all. After some thought, a compromise was decided upon, and photograph No. 4 shows the general construction. It is important that a hard wood be used for the guides and runners, and as some oak was obtainable, this was used. The runners which are screwed to the sides of the drawers, were located by placing them between two pieces of wood which was used for the guides, and screwed into place. In a similar manner, the guides were positioned on the cross-pieces, but a piece of $\frac{1}{16}$ in. packing was placed between the top guide and the top planks of the stand to provide clearance for the drawer. The backs and fronts of the drawers were merely screwed to the sides, and the screw heads at the front will be filled in with plastic wood later on. It should be noted that the fronts of the drawers are made wide enough to cover the guides when the drawers are closed, which also prevents their being pushed in too far. The bottoms are just rectangles of $\frac{1}{16}$-in. aluminium screwed on and supported by lengths of 1-in. × 1-in. × $\frac{1}{16}$-in. brass angle.

Editor's Correspondence

A Nice Little Steam Engine !

DEAR SIR,—I recently advertised in your columns for a horizontal steam engine, fully expecting to receive one—or maybe—two replies. But I was inundated with well-worded descriptions of engines for sale, the replies to my advertisement having already run into double figures. Indeed, I begin to wonder if *every* model engineer has not somewhere, tucked away in his workshop, a nice little steam engine !

Be that as it may, and whatever your requirements, it would seem certain that the right advertisement in the right place is a sure method of fulfilling such.

With your permission, Sir, may I be allowed, through the medium of your columns, to thank certain gentlemen who have placed before me such tempting offers !

Yours faithfully,
N. Wales. BERTRAM C. JOY. M.I.Mech.E.

Machine Tool Design

DEAR SIR,—The letter from "Simplex" in the November 18th issue, and his reference to the article by "Duplex," serves to emphasise the gap that exists between the average amateur's lathe at round about the £50 mark, and the small toolroom lathe at five or six times the price, of which many superb examples were to be seen at the recent Machine Tool Exhibition. I am sure that there are many amateurs who would much prefer a larger, more robust and accurate lathe than the average 3 in. - 4 in. machine offered to them at present, and I therefore put forward the following suggestion for the consideration of your readers and, what is equally important, for the consideration of the manufacturers.

I suggest that a manufacturer should place on the market the "bare bones" of say a 5 in. lathe of robust and accurate design, consisting of a bed about 50 in. long and 7½ in. wide, with two raised V's and two flats, planed and finished ground to a high degree of accuracy. With it should be offered machined castings of head and tailstocks, bored to the same accuracy and a saddle and slotted cross-slide of ample proportions. Those who do not possess a lathe would also require mandrel and tailstock spindle, leadscrew with handle, cross-slide screw, nuts and so on. Those who do possess a lathe could make many or all of the parts required to turn the above into a first class plain lathe.

From this beginning and the addition of a dividing-head and milling attachment, the lathe could be fitted with back gear, screw-cutting and self-acting gears, fully automatic apron with separate feed shaft, all with the comforting knowledge that all refinements were being added to something of fundamental accuracy and robustness. I suggest that partly or wholly machined castings would be supplied for these additions, and also such parts as the rack, leadscrew and slotted feed shaft, which would probably be beyond the capacity of the amateur's shop. Thus the amateur could improve the versatility and convenience of his lathe as pocket and inclination dictated, and the accuracy would only be limited by his skill and enthusiasm.

At the present moment the energies of the manufacturer are wholly absorbed by the demands of industry and export, but doubtless the time will come when the market that such a scheme would open up will be well worth catering for. In addition of course, the complete lathe, with a plain cross-slide in place of the slotted one, would doubtless find a market in the regular engineering industry.

In conclusion, I must emphasise that I have no connection with the engineering industry in a professional sense, so I hope that anyone who is in closer touch with the business side of lathe manufacture will comment and advise on the above.

Yours faithfully,
Orpington. N. C. SCOTT.

Support Home Industry

DEAR SIR,—With reference to the recent discussion about commercial engines in competitive model events, I think many correspondents are overlooking the fact that, to the genuine enthusiast, the greatest satisfaction comes from building engines, and while racing successes are very gratifying, they are not the main object in mind.

I always believe that the spirit of model engineering consists of good fellowship and good workmanship, making models and making friends.

Yours faithfully,
KENNETH G. WILLIAMS.
Bournville Model Yacht and Power Boat Club.

Building a Gas Torch

DEAR SIR,—In reply to enquiries for further details of the construction of this device, I have found that the use of flexible tubing as an extension for the gas torch is liable to introduce considerable back pressure, causing a tendency for the burner to light back into the tube. Although this can be prevented by the gauze disc flame trap inserted at the nozzle, the restriction entails more load on the motor and it may be found necessary to increase the operating voltage from 12 to 14 volts to maintain the normal volume of air.

The address of the supplier of the fan and motor, which can be obtained post free for 17s., is, The London Radio Store, 23, Lisle Street, London, W.C.2.

Yours faithfully,
Banstead. A. R. TURPIN.

EXHIBITIONS VISITED

OCTOBER 2nd last was an occasion for a number of people in Southport, for it saw the opening of what was the first model engineering exhibition Southport had ever seen. Not only that, it was the first attempt of a club only three months old at that time; I refer to the Southport Model and Engineering Club. Having regard to this fact, I have no hesitation in saying that the show was a credit to all who had a hand in its organisation and presentation.

The variety and standard of models generally was good. The inclusion of a Hornby tinplate train set in operation was somewhat discordant, and I hope next time a representative model railway will be on view.

I always find it difficult and a little unfair to single-out models for special notice in an article of this kind, as so often if one knew the difficulties that had been overcome in building models, one would give notice to many which pass unheralded. However, I would mention a 1-in. scale "M.E." Traction Engine by J. Dainton, a very neat model; the well-built frames for a 2½-in. gauge L.M.S. Pacific by P. F. R. Hogan, also his L. & Y. 4-6-0; the latter was spoilt by poor lettering (very often the case, this).

I am not attempting to single-out any individual models for the aircraft section, as the standard here was markedly uniform. In any case, there were 63 models from which to choose!

The shipping section, appeared on the surface, to be a one-man effort, as no fewer than 27, nearly half the total number of ship models, was the work of one man, Mr. N. H. Greenwood, of Southport. A remarkable effort this; but, frankly, I could not help but feel that the enormous amount of work that had gone into the making of such a variety of models (by the way, they were nearly all large glass-case jobs) could have been better spent in building fewer but more detailed craft. Perhaps I should mention that Mr. Greenwood's range included *Ark Royal* (1588) and the new Cunard-White Star T.S.S. *Caronia*!

In all, over 9,000 enthusiasts visited the show, which speaks well of the model engineering fraternity in and around Southport.

Wednesday, October 20th, saw the official opening by Alderman W. G. L. Sheppard, J.P., of the Guildford Area M.E. Exhibition.

Four societies were here represented, viz. the Aldershot and District Society of Model Engineers, Godalming and District Society of Model Engineers, Guildford Model Yacht and Power Boat Club and Messrs. Vickers-Armstrong Ltd. (Weybridge) Social Club, Model Section.

I am afraid the standard of workmanship of many models was somewhat disappointing. Many promising models had been spoilt by poor painting or failure to take just that extra care that results in a first-rate production.

There were, however, some marked exceptions to the above comment which put the exhibition right on top. In this category was included a really splendid model roundabout by Mr. A. S. Finter, of the Guildford Club. This working model was as complete as anything I have yet seen. Even the music was typically "fair-ground"!

Dr. and Mrs. R. M. Graham-Pole had on view a selection of superbly-executed 4-mm. scale miniature figures, showing a cavalcade of military personnel through the ages. A remarkable contrast was set up by the gay coloured uniforms of yore and the present-day drab khaki! From the same hands came a number of 4-mm. railway vehicles, coaches *a la* L.N.W.R. and some wagons. The doctor and his wife are to be congratulated for their joint efforts. The result of careful attention to detail and fine workmanship, if ever I saw it.

J. C. Walker, of Vickers-Armstrong, exhibited a remarkably accurate model G.W.R. "King" bogie, built to a scale of ¾-in. to the foot. *If* this bogie is ever fitted to a completed model, and *if* the standard of workmanship is maintained, the result will really be something to write about!

The Guildford Model Yacht and Power Boat Club had a really first-class array of yachts on display. Some very fine work was evident here.

"Live Steam" never fails to fetch the crowd! A 3½-in. gauge free-lance 2-6-2 was here the attraction. She was inclined to slip rather a lot when I was there, but once she got hold of her train she spoke "volumes" for her builder. Her passengers had no complaints and that's what counts after all!—K. G. MANSELL.

A Model Railway Show in Manchester

THE Manchester Model Railway Society will be holding their annual exhibition at The Corn and Produce Exchange, Hanging Ditch, off Corporation Street, Manchester, on Friday and Saturday, December 17th and 18th. It will be open from 11 a.m. to 9 p.m. each day.

The Corn Exchange is three times the size of the old hall and it is hoped that the increased capacity will avoid some of the congestion and queueing that occurred at peak periods last year.

Many more models have been promised particularly in the larger gauges and live steamers. Five or six demonstration tracks and layouts will be in constant operation throughout the exhibition, including "HO," "OO," "EM," "O," "1" and 2½ in. gauges.

Several local clubs are contributing loan exhibits and it is fully expected that this year's exhibition will be in every way bigger and better than before.